PARSONS, A.L.

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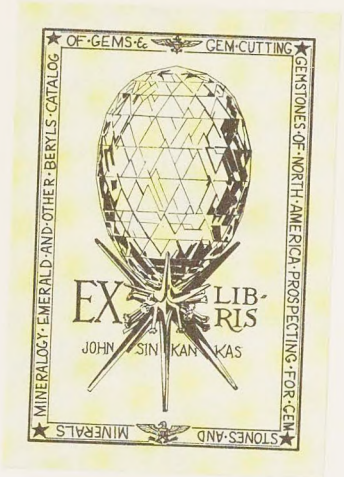
MOLYBDENITE
IN ONTARIO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MOLYBDENITE DEPOSITS OF ONTARIO

By A. L. PARSONS

Introduction

In accordance with instructions from T. W. Gibson, Deputy Minister of Mines, the writer undertook the investigation of the molybdenite deposits of Ontario during the months of May, June and September, 1916. In this work an effort was made to visit every producing locality, and nearly every known prospect in the eastern part of the province was examined. In a few instances where previous descriptions indicated that deposits were of no commercial value, recorded localities were not visited, but in every such case information was received from men who had investigated the deposits which confirmed the previously published descriptions. Although it was known that there are many occurrences of this mineral in the western part of the province, some of which had been seen by the writer a few years ago, it did not seem desirable to extend the work in this direction, as the known deposits that have been described are in nearly all cases too small and too poor in molybdenite to be of economic importance. It was, however, deemed advisable that the deposit on Gull lake, near Dryden, should be examined and E. Thomson was instructed to visit this property. Another property in the Manitou lake region was also visited by Mr. Thomson; and the descriptions of these occurrences are included in this report.

In the investigation, a feature of prime importance was the ascertaining of the common mode of occurrence of the mineral, as a guide to prospecting for further economic deposits. There seemed to be particular need of this, as the common association of molybdenite in eastern Ontario is such that a person reading the ordinary descriptions of the occurrence of this mineral would be likely to look in almost any other place than where it is most likely to occur. Dr. T. L. Walker has given a brief description of this type of occurrence,[1] and has indicated it as being typical. In view, however, of the almost universal generalizations that are ordinarily given, it is desirable to emphasize the statement that nearly every deposit of commercial importance in eastern Ontario is at or near the contact of granitic rock and crystalline limestone.

An attempt was also made to get an estimate of the quantity of molybdenite available in the various mines and prospects. This, however, is an extremely difficult matter in most cases for two reasons; first, because the rich specimens have usually been taken away, so that the stock piles and dumps consist of low grade material; and second, the weathering of the rock and ore exposed in the mine results in the oxidation of the molybdenite to molybdite, which is usually worn away from the exposed surface.

[1] Mines Branch Bull. 93, Molybdenum Ores of Canada, p. 9.

Molybdenum Minerals

In studying the possibility of increasing the production of molybdenum, it is of interest to tabulate the known minerals which contain this metal, and to consider the chemical and physical properties of each, as well as the mineral association. In certain cases this may lead to the discovery of other substances of considerable economic importance. The known natural compounds of molybdenum are the following:

Molybdenite	MoS_2
Molybdite	$Fe_2O_3 3\ MoO_3.7½\ H_2O$
Ilsemannite	$MoO_2.4MoO_3$
Wulfenite	$PbMoO_4$
Powellite	$CaMoO_4$
Belonesite	$MgMoO_4$
Achrematite	$3(3\ Pb_3As_2O_8.\ Pb.\ Cl_2.)\ 4(Pb_2MoO_5)$
Koechlinite	$Bi_2O_3.MoO_3$
Pateraite	
Eosite	
Molybdosodalite	

Molybdenite is the commonest ore of molybdenum, and at present the only one found in Ontario in economic quantities. It looks much like graphite, and occurs in scales which are sometimes so minute as to require a microscope for their detection, while at other times the scaly masses may be as much as a foot in diameter. Occasionally these scales radiate from a common centre forming nodules, while at times the aggregate may have an earthy texture. In all cases, however, the mineral exhibits a colour which may be used to distinguish it from graphite, the only mineral with which it is likely to be confused. The colour is a bluish lead gray, while graphite is black to brownish black. If, however, the colour does not serve as a distinguishing feature, it is easily tested by making a mark with it upon paper. Usually this mark is shining and of a bluish colour, because the powdered mineral is not finely pulverized. If, however, this mark is rubbed with the finger, the paper and finger pulverize it still finer, and it becomes grayish green. No other mineral which will make a mark on paper will yield this colour. Although so extremely soft, it is decidedly heavy (sp. g. 4.7), and its greater specific gravity might also be used to distinguish it from graphite.

Molybdite is a straw-yellow to canary-yellow mineral, which is frequently found near the surface as a result of the oxidation of molybdenite. It was formerly supposed to be pure molybdic acid, but recent investigations by Schaller show it to be a hydrous ferric molybdate. It is occasionally found in sufficient quantity to be useful as an ore, but at present it is doubtful whether this mineral can be recovered from Ontario ores economically.

Wulfenite is probably the second most important ore of molybdenum. It is usually honey yellow to orange red in colour, is easily scratched with a knife (hardness 3) but not by the finger nail, has a specific gravity of about 7, and occurs in thin tabular crystals. Occasionally the crystals develop a pyramidal habit. It occurs in considerable abundance in Arizona, New Mexico, Nevada and California. It is found principally near the surface along with other oxidized ores of lead.

In view of the large deposits of this mineral, it would be natural to expect to find the sulphides of lead and molybdenum intimately associated. This, so far as the writer has observed, is not the case, but it is of interest to note that lead deposits are found in certain parts of eastern Ontario, not far from molybdenum-producing localities. Whether these deposits belong to the same period of ore deposition as the molybdenite is an unsolved question, but if they do it is possible that a mineral containing both lead and molybdenum would occur at a certain depth.

Koechlinite is a mineral which has recently been described by Schaller.[2] It occurs in small greenish tabular crystals resembling torbernite, and is associated with quartz, native bismuth, smaltite, a red mineral (realgar?), a few needle-like prisms of a gray metallic mineral (bismuthinite?) (stibnite?), and three unidentified minerals. The original material came from Schneeberg, Saxony. In composition it is a molybdate of bismuth (Bi_2O_3. MoO_3.) Two points of interest are to be borne in mind. The association is the Cobalt silver association, and so indicates the possibility of the existence of this mineral in Ontario. The possiblity of a similar mineral containing sulphur instead of oxygen at greater depth is to be considered. The association of molybdenite and bismuthinite is common, and it is desirable to examine such deposits carefully for unknown minerals.

Belonesite is a substance crystallizing in small needle-like crystals in one of the lava flows at Vesuvius. From qualitative tests it was shown to contain magnesia and molybdic acid.

Powellite is a rare mineral found at the Peacock lode in the Seven Devils mining district in Idaho. It consists principally of calcium molybdate, but contains in addition some calcium tungstate.

Achrematite is a massive material found in the mines of Guanaceré, Chihuahua, Mexico. The composition corresponds to a mixture of mimetite, massicot and wulfenite.

Ilsemannite is a blue-black to black crypto-crystalline mineral, which becomes blue on exposure. It is soluble in water, giving a deep blue solution. It is a product of the decomposition of metallic molybdates. It is probably owing to the presence of this mineral, that pyrrhotite and pyrite when associated with molybdenite are tarnished so as to be readily mistaken for bornite and chalcopyrite.

Pateraite is a black massive mineral supposed to be a molybdate of cobalt from Joachimsthal. The material was so intimately mixed with pyrite and bismuthinite that it could not be completely separated and the exact composition is unknown.

Eosite from micro-chemical tests is assumed to be a vanado-molybdate of lead.

Molybdosodalite is a variety of sodalite from Monte Somma which contains over 2 per cent. molybdenum trioxide.

So far as the Ontario deposits are concerned, the only one of the minerals enumerated above that is of importance is molybdenite, though in a few instances the molybdite is sufficiently prominent to suggest the possibility of economic recovery by leaching the ore with ammonia before further concentration.

[2] U. S. Geol. Sur., Bull. 610, pp. 10-34.

A New Molybdenum Mineral

A dark green mineral rich in molybdenum occurring as an incrustation on specimens of ore from Lucania Tunnel near Idado Springs, Colo., has recently been discovered by F. B. Laney of the United States Geological Survey.[3] The mineral itself has not yet been fully examined, but an analysis of the mine water, which is of a deep blue colour and has a specific gravity of 1.031 at 25° C., yields a high molybdenum content. This analysis shows in grams per litre:

Molybdenum trioxide (MoO_3)	7.98	Magnesium	.73
Molybdenum dioxide (MoO_2)	Trace	Sodium	.26
Ferrous Iron	2.01	Potassium	.14
Ferric Iron	1.75	Sulphate (SO_4)	18.26
Aluminium	.27	Chlorine (Cl)	.17
Calcium	.50	Hydrogen (of free acid)	.13

In addition to the minerals mentioned above, we have minerals of somewhat doubtful character, mentioned in various publications. Molybdurane is supposed to be a molybdate of uranium, and is said to be found at Joachimsthal, Bohemia. Knightite is said to be a phosphate of molybdenum, found at Catherine's Hill in the State of Maine. Molybdo-ferrite is said to be an anhydrous ferrous molybdate. The writer has been unable to find the original descriptions of these minerals. A source of molybdenum which may be of considerable value in certain regions is scheelite, the tungstate of lime. This mineral frequently contains molybdenum in place of part of the tungsten, and in certain instances the molybdic acid is more than 8 per cent. of the mineral. In connection with this it may be mentioned that in the analysis of powellite, the molybdate of lime, more than 10 per cent. of tungstic acid was found.

Geological and Mineralogical Association

The geological and mineralogical association of molybdenite vary materially in different mining regions, and a rule for prospecting which might be valuable in one region would be useless in another. In general, however, it may be said that it is found in or near granitic rocks, though it is seldom an original constituent of these rocks. The principal types of occurrence are:

(*a*) Pegmatite deposits, in which the molybdenite is associated principally with quartz and feldspar, with smaller quantities of mica and pyroxene.

(*b*) Quartz veins, which often carry, in addition to the molybdenite, ores of bismuth, tin and tungsten, and frequently tourmaline. Pyrite and pyrrhotite are also frequently found in these veins. Sometimes copper ores are also associated with the molybdenite, but in Ontario this is not common.

(*c*) Mineralized crevices in granitic rocks, where the molybdenite has been deposited on the walls, but the crevice has not been filled as in (*b*) with quartz or other vein matter. Such deposits are frequently very showy, but are of little economic value.

(*d*) "Pipes" of silicious material in granite, carrying molybdenite and bismuth, such as the deposits at Kingsgate near Glen Innes, New South Wales, and Wolfram Camp, Queensland.

[3] U. S. Bur. Mines, Bull. 111, p. 15.

(*e*) Biotite granite carrying molybdenite as an original constituent, is described from Mt. Stronach, near Scottsdale, Tasmania.

(*f*) Contact deposits at or near the contact of granite and other rocks. These, so far as our knowledge goes, are by far the most important of the deposits in eastern Ontario, and possibly of western Ontario as well. In general, they lie at the contact of granite or pegmatite with crystalline limestone in a zone of pyroxenite, which has presumably been formed by the metamorphic action of the granitic mass upon the limestone. In these deposits pyrite and pyrrhotite are almost universally present, while the other associated minerals are quartz, calcite, tourmaline, phlogopite, titanite and hornblende.

A variation from the type of contact deposit common in Ontario occurs in Tasmania, where the ore on King Island is said to consist essentially of garnet with quartz, epidote, calcite, monoclinic pyroxene and actinolite. The metallic minerals are scheelite, molybdenite, pyrite and bismuth. This deposit is very close to a contact with granite, and probably represents a more highly metamorphosed type than most of the Ontario deposits.[4]

Prospecting for Molybdenite

So far as the deposits in eastern Ontario may be used as a guide in prospecting for further deposits of an economic character, the most favourable locations are near the borders of granite masses, particularly when these are in contact with crystalline limestone. In case a band of pyroxenite is found between these two rocks, this should be thoroughly examined for molybdenite, as in all the deposits that the writer has examined pyroxene has been associated with molybdenite. As to the conditions in the western part of the province where limestones are almost lacking, it is probable that the molybdenite, when found, will be near the contact of granite and the basic igneous rocks. In the few instances where the writer has seen deposits of molybdenite in the western part of the province, this is the case, but he has not seen a sufficient number to warrant him in stating definitely that it is the rule.

Concentration

Hitherto the concentration of molybdenite has been one of the most difficult problems in ore dressing. This has been due in part to the high molybdenum content demanded by the market, and in part to the character of the mineral. For ores which contain no bismuth or copper the standard of the market is too high for the best interests of the industry, as the demand is for a concentrate that will carry from 90 to 95 per cent. MoS_2. In the case of the ores from eastern Ontario as well as other ores which the writer has seen, it would be more equitable to base quotations on a 70 per cent. concentrate. The impurities in these concentrates are either sulphides or silicates, principally pyrite and pyrrhotite, or pyroxene and mica. In use, the concentrate is either introduced as the sulphide into the furnace, or roasted to convert the molybdenite to molybdic acid. In the first case, pyroxene and mica would be removed in the slag, while the pyrite and pyrrhotite would furnish a source of iron for the manufacture of ferro-molybdenum.

[4] Geological Survey of Tasmania, Mineral Resources, No. I, Part III, page 10.

In that case the value of the concentrate should be based on the molybdenite content, and the iron values should be added.

In case the molybdenite is to be roasted, these accompanying minerals are of no value, but are also harmless, and are removed with little difficulty in the subsequent leaching of the roasted mass.

As a preliminary to further treatment of the ores, it is customary to pick out by hand large flakes, as the loss in crushing, rolling and screening of this type of material is comparatively large. In all concentrating mills the ore is reduced to a size that will pass a 20-mesh screen. Extremely fine grinding is not to be desired in most cases, as that portion of the rolled material which passes through a 60-mesh screen is found to carry an almost negligible quantity of molybdenite. In consequence, the best results will probably be obtained by crushing and rolling the ore to pass a 20-mesh sieve, and passing this material over a 60-mesh screen to remove dust, thereby lessening the load on the concentrator.

The various concentrating machines will be discussed in the description of the several plants. Detailed descriptions of well known concentrators are not given, except where some new feature has been introduced for the treatment of molybdenite.

Spain Mill

This mill is owned by Mr. W. J. Spain of New York, and is located at the Spain mine in Griffith township, Renfrew county. A general view of the principal buildings is given in figure 1.

The power is furnished by two 60-h.p. boilers which are located in the building to the left. The engine is in the mill building. Before being brought to the mill, the large flakes of molybdenite are picked out by hand, and the rock containing the smaller material is then put through a jaw crusher. From this point it is carried on a picking belt, where flake molybdenite and waste rock are removed, to a set of rolls which reduce it to about ½ inch. It is then conveyed on a second picking belt to a second series of rolls. The fine material is then dried in a steam drier and bolted, after which it is further concentrated by a Hooper pneumatic concentrator. This represents the practice in the early part of the summer. During the summer, however, a modification was introduced in the form of a Wood's machine.

Renfrew Molybdenum Mines, Limited

This company's mill was in course of construction during the summer, and was not finished at the time of the writer's second visit in September. The manager, Mr. Charles Spearman, however, kindly furnished some particulars of the proposed method of concentration. It is the intention to use the Elmore Vacuum concentrator, and as a preliminary to concentration the ore is crushed and put through a ball mill to reduce everything to a fine state. These fines are then mixed with a certain amount of oil and put through the concentrator, whereby the sulphides are removed as heads, while the remainder of the rock material goes off as tails. The writer did not receive details as to the further treatment for separating molybdenite from the other sulphides. This process is said to be very successful in the treatment of Swedish molybdenite ores.

The accompanying view of the molybdenite deposits of this company shows the boilers and compressor in process of installation. The boiler house was completed, and most of the frame-work for the concentrating plan had been erected, at the time of the writer's second visit in September.

Fig. 1—Buildings at the Spain mine.

Fig. 2—View of outcrop at Renfrew Molybdenum mines.

International Molybdenum Company

The preliminary work of this company in the concentration of molybdenum ores was carried on at their plant in Orillia, but as the concentrating machinery was moved during the summer to their new plant at Renfrew, a detailed description of the latter only will be given.

The ore is first put through a gyratory crusher, which reduces it to an inch mesh, and is then elevated to large rolls. The product of the rolls is screened, and the oversize returned to the large rolls, while that portion of the remainder which will not pass a 20-mesh screen is passed through a second set of rolls, the oversize being returned to these. The pulverized ore is then taken to a concentrator which was devised by the manager, G. P. Grant, a description of which follows.

The concentrator consists of a long wooden vat about 12 feet long in which a series of boards or baffles is placed at right angles to the direction of flow of the water. Several types of feed have been tried, two of which have proven more successful than the others. For very fine material, a gentle blast of air blows the ore over the surface of the water and as the current of water carries this material over the baffles the surface tension is altered, so that the more angular pieces sink while the flaky material remains on the surface. The material thus floated is received in a tub provided with a screen which permits the water to escape, while the concentrate is retained. This concentrate is then dried on a steam coil. For coarser material, the distribution on the surface of the water is accomplished by a rotating drum covered with cloth, the material being distributed on the drum by a conical feed. The larger fragments sink before reaching the first baffle plate, so that this material is screened to recover large flakes of molybdenite. The rest of the operation is the same as that described above. From this concentrator it is usual to get a product running from 65 to 80 per cent. MoS_2 without further treatment. In case a higher grade is desired, the product is cleaned by screening the finely rolled material, which removes the more angular fragments of pyrite and quartz that may have come over, while saving the flaky molybdenite. No acids or oils are used in the concentration, the principal pre-requisite to the successful concentration being that the material shall be dry.

Mines Branch, Ottawa

A large portion of the testing plant of the Mines Branch, Mines Department, has been devoted during the past year or more to the concentration of molybdenite. Through the courtesy of the Director, Dr. Eugene Haanel, the writer was permitted to examine the plant. The general plan of procedure is to crush the ore in a jaw crusher, after which it is passed through rolls. At the time of the writer's visit a ball mill was being installed for finer grinding. The finely pulverized material is fed to a modification of the Woods flotation machine, but since the writer's visit the operation has been considerably changed, and wet crushing is now possible. At the time of his visit, the ore was fed to the surface of the water by means of an endless apron, and the gangue sank, while the molybdenite remained floating. With the molybdenite a considerable quantity of pyrite and other minerals continued to float, and this was then taken on another apron and re-deposited on the surface of the water. The portion that still floated was drawn off as concentrate. This was further treated by being dried and re-floated so as to remove the iron sulphides which were the principal impurities in the molybdenite after passing over the concentrator. In the modified machine which was described by G. C. Mackenzie before the Royal Canadian Institute, the endless aprons have

been removed, and the ore is fed directly on to the surface of the water, and the breaking of the surface tension is brought about by jets of water from below the surface.

Uses of Molybdenum

The uses for which molybdenum is employed are more numerous than would at first be thought. Of first importance is its use when alloyed with iron to make molybdenum steel. This is an extremely hard alloy, which retains its hardness to a remarkable degree, even when raised to a dull red heat. It is employed as a high speed steel for lathe work, and is also said to be used for rifle barrels and the cores of large guns.

In the chemical industry, large quantities of molybdic acid and ammonium molybdate are employed in the determination of phosphoric acid. Various molybdenum compounds are employed for dyeing fabrics, colouring leather and rubber, and porcelain painting. Certain compounds are said to be used for fireproofing cloth.

The method of preparation of many of the compounds is secret, and depends upon making them at certain temperatures and with other conditions carefully adjusted. This is shown most strikingly in the preparation of molybdic acid, which may be obtained in a crystallized state by observing proper precautions, while the neglect of these precautions gives rise to the production of a chalky mass of a much lower grade of purity.

Among minor uses for which molybdenum or molybdenum compounds are employed the following may be mentioned:

The metal is employed in the electric resistance furnace in place of platinum because it is not only cheaper but gives quicker heat, and higher temperatures are attainable. For this purpose, however, the molybdenum must be protected from the air, as at high temperatures it is attacked by oxygen.

In the incandescent electric lamps, the supports for the filaments are made of metallic molybdenum.

In certain contact making and breaking devices, molybdenum is used as a substitute for platinum and platin-iridium.

In the Coolidge X-ray tube a considerable proportion of ductile molybdenum is employed.

In dentistry it is stated that molybdenum wire covered with gold is utilized to some extent.

A molybdenum-tungsten thermo couple has been recommended for measuring high temperatures.

It is said that molybdenum is employed in some form for the preservation of cordite in hot climates, but no definite information on this subject appears to have been published. It is also affirmed that molybdenum is used in the synthetic preparation of ammonia under processes covered by German patents. Several alloys of considerable interest and possibly of prime importance of molybdenum with other metals are known. Among these may be mentioned molybdenum-nickel, molybdenum-chrome and molybdenum-stellite, the last mentioned being composed principally of molybdenum, cobalt, chromium and iron.

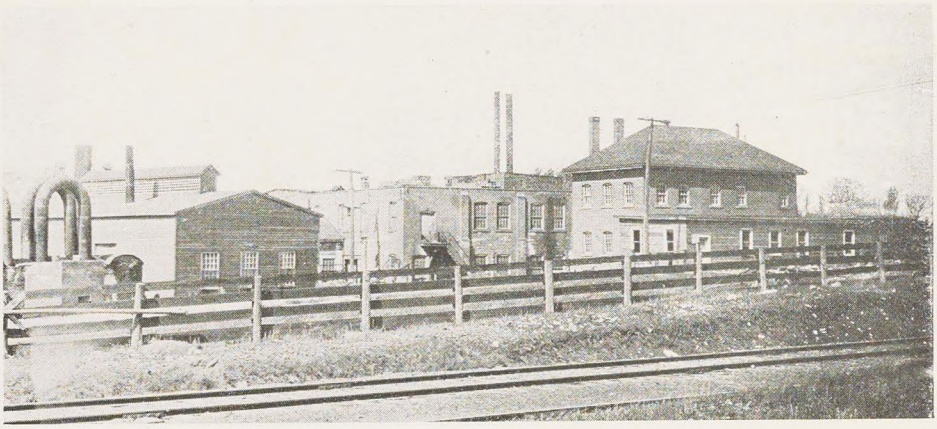


Fig. 3—Partial view of plant of the International Molybdenum Company at Orillia.

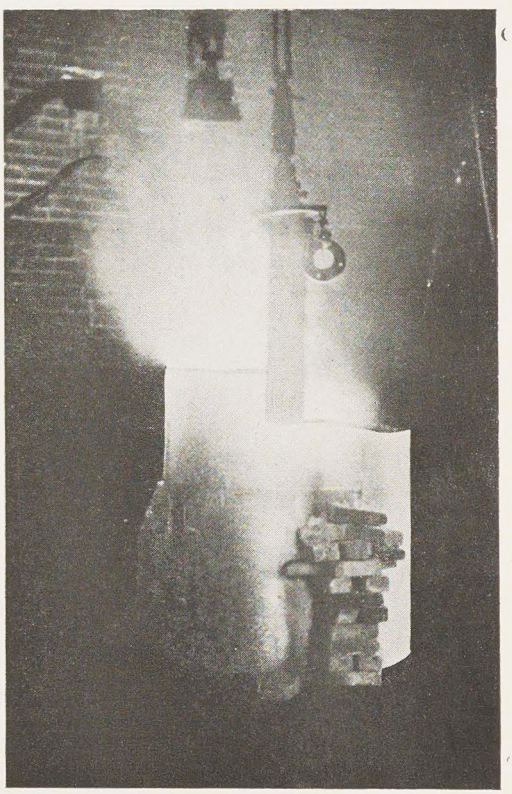


Fig. 4—Electric furnace making ferro-molybdenum, International Molybdenum Co., Orillia.

The artificial compounds of molybdenum are so numerous that it is not desirable to make a list of them at this place, but for an extended description ofthese the reader is referred to an excellent description of the substances by Moissan.[5]

Ferro-Molybdenum Industry

Two firms in Ontario have undertaken the manufacture of ferro-molybdenum during the past year, The International Molybdenum Company and the Tivani Electric Steel Company. In the early stages of the work both companies encountered serious difficulties, but with more complete knowledge of the physical and chemical conditions necessary for the proper reactions, these difficulties have disappeared, and both companies are now steady producers. Apart from the purely technical difficulties, the industry was seriously hampered by the scarcity of suitable refractory material for the furnaces, and at one time it was difficult to secure suitable electrodes.

The International Molybdenum Company made an experimental run on a laboratory scale at their Orillia plant on May 8th, 1916, and secured a small quantity of beautiful ferro-molybdenum. This product consisted of tabular crystals and a fine granular mass, and while the main mass ran over 70 per cent. Mo. it was stated by G. P. Grant that the tabular crystals contained about 52 per cent. Mo. This latter would probably be equivalent to Fe_3Mo_2 which would contain 53.3 per cent. Mo and 46.7 Fe. In September the company began work on a commercial scale. The furnace is a single arc tapping type, as seen in Fig. 4. The capacity of the original furnace as shown was about one hundred and twenty-five pounds. In the earlier runs pure molybdic acid was mixed with iron, flux and coke. Later runs were made with roasted concentrates, which in some cases still carried sulphur. The resulting ferro-molybdenum in both cases was practically free from sulphur, as this is volatilized in the intense heat of the arc, or is in part taken up by the slag.

The Tivani Electric Steel Company, Limited, of Belleville, have been making ferro-molybdenum since September, 1916. At the time of the writer's visit a charge was being treated in a triple arc Evans-Stansfield furnace which is illustrated in figure 5. As will be noticed, this is a large furnace and is easily manipulated. The charge is introduced through the door at the side, and the slag and molten metal are poured by tilting the furnace and allowing the molten material to flow out of the spout just above the man's head. A smaller two-arc tapping furnace was used for an earlier run and is shown in figure 6. This company has been shipping ferro-molybdenum steadily during the autumn. The charge that was being treated at the time of the writer's visit was composed of molybdenite, with the proper addition of iron and flux. The sulphur in the molybdenite was practically all taken up by the slag, or converted into sulphur dioxide, so that the resulting ferro-molybdenum was practically free from sulphur. As a result of this, the writer has recommended in another part of this report that the grade of molybdenite concentrates should not exceed 70 per cent. when pyrite and pyrrhotite are the only impurities, as these will furnish the necessary iron for the alloy, with a saving in cost of concentration. The first run from this furnace yielded about one hundred pounds of ferro-molybdenum.

[5] H. Moissan, Traits de Chimie Minerale, 1905, T. IV, 685-758.

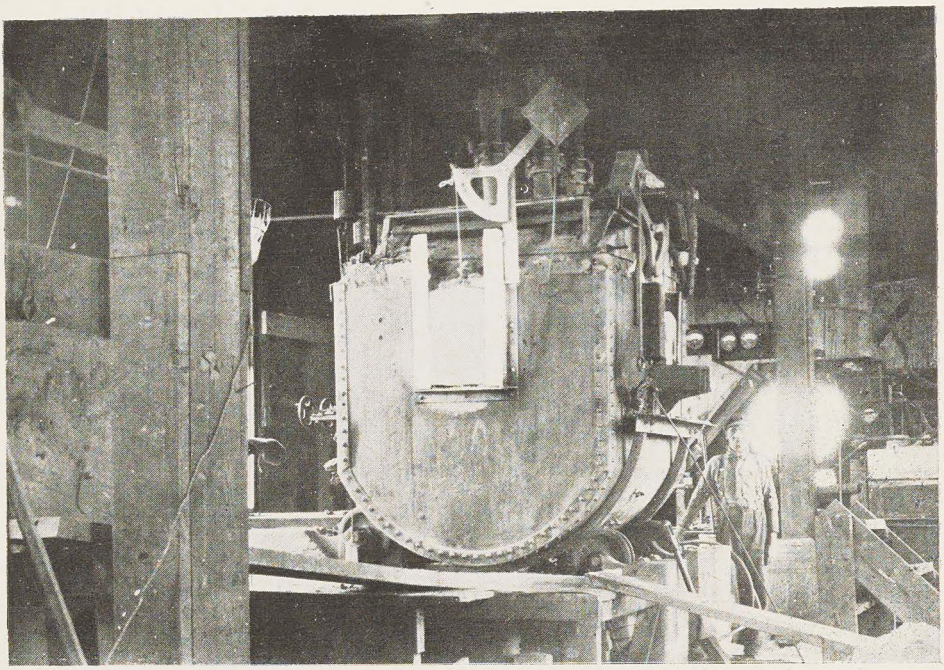


Fig. 5—Electric furnace making ferro-molybdenum, Tivani Electric Steel Co., Belleville.

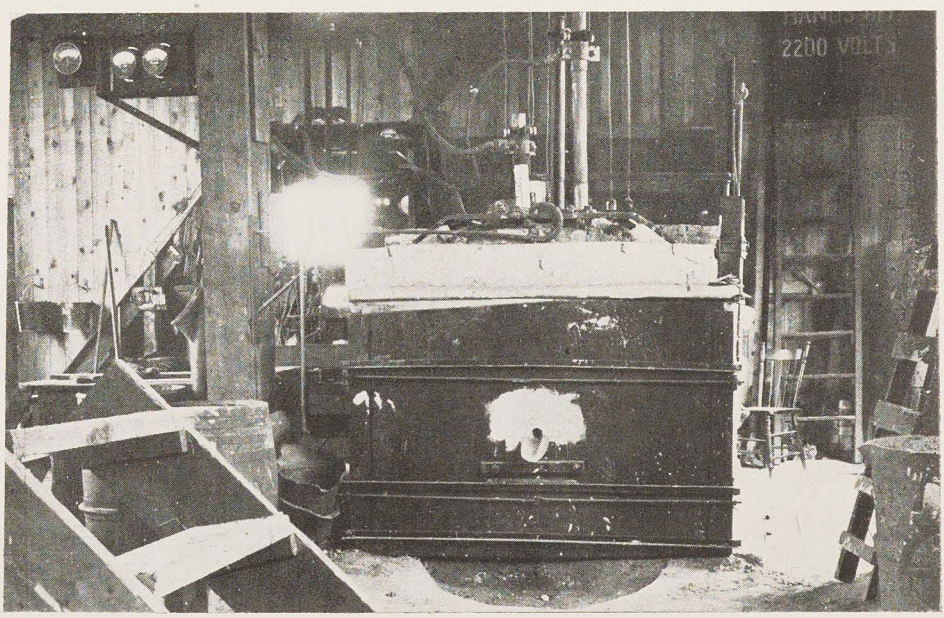


Fig. 6—Electric furnace, Tivani Electric Steel Co., Belleville.

Ontario Mines and Deposits

The molybdenum deposits of Ontario are very numerous, and with the prospecting that has been carried on the list may undoubtedly be greatly extended. The mineral occurs in nearly all parts of the Province where pre-Cambrian rocks are found. In the description the various occurrences have been taken up alphabetically according to the townships in which they are located. The following summary by counties and districts will serve to indicate in a brief manner the general distribution, which is also shown on the sketch maps accompanying the report:

ADDINGTON COUNTY; Sheffield township.
ALGOMA DISTRICT; Molybdenite lake.
CARLETON COUNTY; March township.
FRONTENAC COUNTY; Miller and Olden townships.
HALIBURTON COUNTY; townships of Cardiff, Harcourt and Monmouth.
HASTINGS COUNTY; townships of Carlow, Dungannon and Monteagle.
KENORA DISTRICT; Gull lake, Ignace, Lake of the Woods, Lac Seul, Manitou lake, Smooth Rock lake and Wabigoon lake.
LEEDS COUNTY; North Crosby township.
MUSKOKA DISTRICT; Monck township.
DISTRICT OF NIPISSING; townships of Airy and Roberts, and near Talon Chute (not molybdenite).
PETERBOROUGH COUNTY; townships of Anstruther and Belmont.
PARRY SOUND DISTRICT; Foley township.
RAINY RIVER DISTRICT; Rainy lake and Steep Rock lake.
RENFREW COUNTY; townships of Bagot, Blithfield, Bromley, Brougham, Griffith, Lyndoch, Matawatchan, Raglan, Roberts, Ross and Sebastopol.
SUDBURY DISTRICT; townships of Denison, Garrow, Graham and Drury (Worthington mine).
THUNDER BAY DISTRICT; Big Duck lake, Conmee township, Terrace Cove (Black River), (Seabeach Bay), Longuelac, and Tamarack lake.
TIMISKAMING DISTRICT; Beatty township, Kirkland lake, Net lake, Porcupine and Swastika.

In the description of the deposits of molybdenite every known locality is mentioned. Where it is definitely known that any deposit is not of an economic character, it is so stated. In many cases, however, a deposit which is at present not economic, may with further development become a very desirable property. When the writer has not seen a property, he has given the best opinion available in regard to the deposit with the authority for the opinion.

Anstruther Township

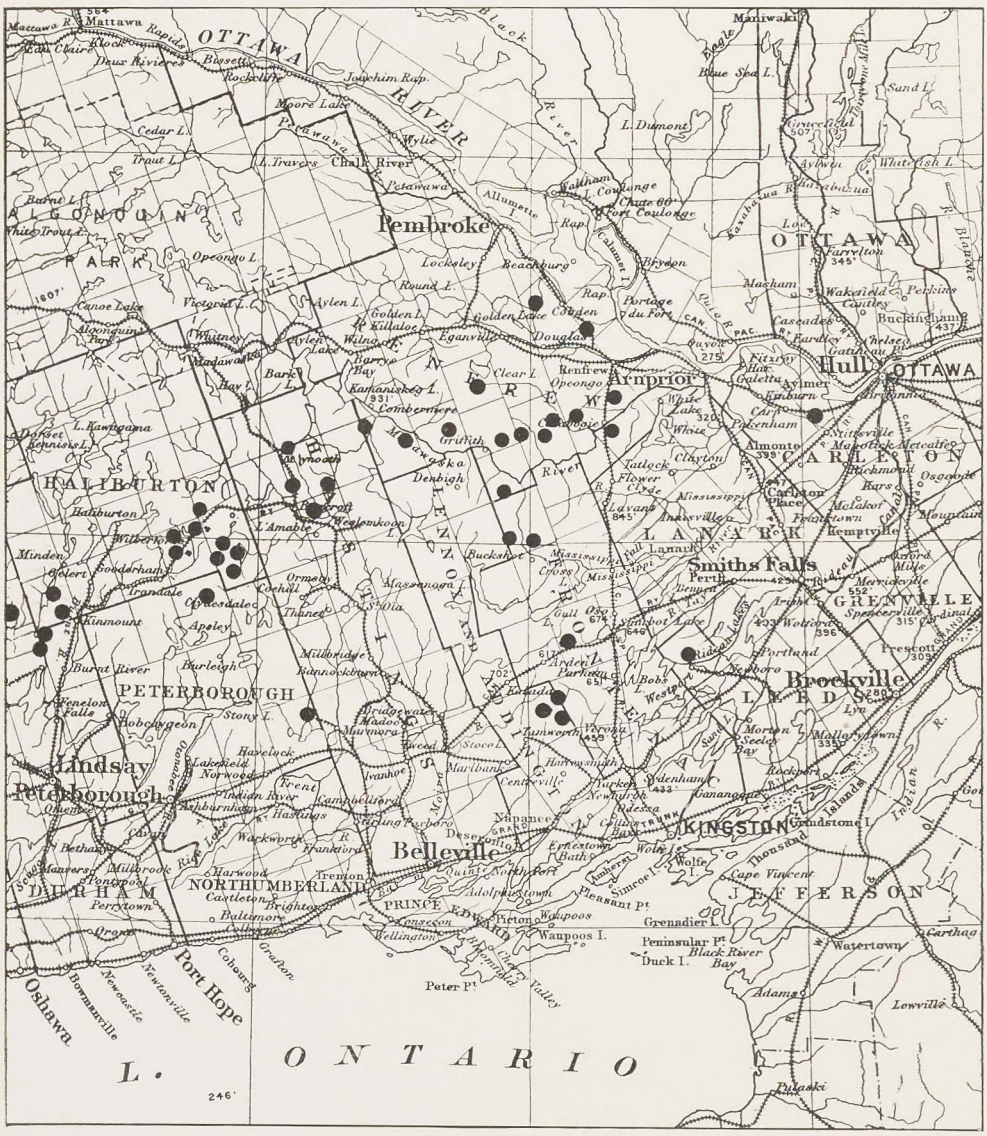
Molybdenite is reported from lot 24 or 25, concession XIV,[6] but so far as the writer has been able to ascertain no development work has ever been done here. The locality is close to the contact between crystalline limestone and gneissoid granite, and should be further prospected.

Airy Township

District of Nipissing. Molybdenite was reported from two locations near the boundary of the Algonquin Provincial Park. One of these was visited by the writer, and it was found that the material was graphite rather than molybdenite. Unfortunately, the gentleman who showed this property did not know the location

[6] Ont. Bur. Mines Vol. XII, p. 56.

of the second reported occurrence, so that the writer was unable to examine it. He was, however, shown samples of molybdenite by G. W. Bartlett, Superintendent of the Park, which had come from some portion of the latter. As to the extent of the deposits, however, nothing was known.


OTTAWA RIVER
ALGONQUIN PARK
Pembroke
Arnprior
Renfrew
Smiths Falls
Brockville
Lanark
Lanark
Leeds
Grenville
Carleton
Hull
OTTAWA
Ottawa
HALIBURTON
PETERBOROUGH
Lindsay
Peterborough
Belleville
KINGSTON
Frontenac
Addington
Hastings
NORTHUMBERLAND
DURHAM
PRINCE EDWARD
JEFFERSON
Port Hope
Oshawa
L. ONTARIO
Peter Pt
Waupoos I.
Duck I.
Grenadier I.
Wolfe I.
Amherst I.
Cape Vincent
Watertown
Carthag
Lowville
Pulaski
Adams
Bay of Quinte
Trent R.
Moira R.
Madawaska R.
Bonnechere R.
Mississippi R.
Rideau R.
Gananoque
Brockville
Morton
Seeleys Bay
Mallorytown
Lyn
Thousand Islands
Windmill Point
Wolfe Island
Kingston
Portsmouth
Collins Bay
Cataraqui
Bath
Adolphustown
Napanee
Deseronto
Tyendinaga
Belleville
Trenton
Frankford
Campbellford
Havelock
Norwood
Lakefield
Peterborough
Ashburnham
Indian River
Otonabee
Stony L.
Burleigh
Bobcaygeon
Fenelon Falls
Burnt River
Minden
Haliburton
Kinmount
Apsley
Coboconk
Cameron
Lindsay
Omemee
Bethany
Millbrook
Manvers
Port Perry
Cartwright
Orono
Newcastle
Bowmanville
Oshawa
Whitby
Pickering
Markham
Stouffville
Uxbridge
Scarborough
Toronto
Mimico
Weston
Richmond Hill
Aurora
Newmarket
Sutton
Georgina I.
Holland R.
Lake Simcoe
Beaverton
Thorah I.
Brechin
Orillia
Washago
Gravenhurst
Muskoka L.
Bracebridge
Huntsville
Dwight
Algonquin Park
Whitney
Madawaska
Barry's Bay
Eganville
Douglas
Golden Lake
Killaloe
Golden L.
Round L.
Arlen L.
Victoria L.
Canoe Lake
Opeongo L.
Lockesley
Beachburg
Allumette
Rapid
Chalk River
Petawawa
Moore Lake
Joachim Rap.
Mattawa
Rapides
Rocklin
Blossett
Deux Rivieres
Cedar L.
Trout L.
L. Travers
White Trout L.
Burke L.
Round L.
Lake Clear
Kamaniskeg L.
Combermere
Griffith
Denbigh
Bancroft
Wollaston L.
L. Amable
Wilberforce
Halliburton
Dorset
Kennisis L.
L. Kawagama
Maynooth

wide and about 15 feet long, and is sunk on a pyroxenite pegmatite dyke in crystalline limestone. The molybdenite-bearing portion is about a foot wide, and carries also some pyrite and tourmaline. The specimens seen, however, were decidedly lean, and the deposit does not appear to be of economic value.

On lot 28, concession XII, on the farm of John Culhane, development work has been done by R. R. Gamey, M.P.P. The principal pit is about 40 by 8 by 4 feet. Mr. Culhane informed the writer that about 200 pounds of flake molybdenite was taken out. There was still to be seen on the dumps possibly a ton of concentrating ore, and a few pounds of flake molybdenite which had been laid aside in tins.

On the farm of William Warren, lot 27, concession IV, considerable development work has been done by Mark J. Paterson and Sir Henry Pellatt. At the time of the writer's visit, however, the pits were filled with water, and the molybdenum-bearing rock was seen only in the stock piles. About four tons of concentrating ore was seen. The writer has since been informed that additional material was stored in barrels.

Lot 25, concession IV. Mr. Morin of Springtown showed samples of molybdenite, which he said came from his farm on the above location. Only one shot had been put in. Conditions were such that Mr. Morin could not take the writer to the place without considerable delay, so that this location was not seen. The samples, however, were of the typical molybdenite-pyrrhotite-pyroxenite association.

Beatty Township

On the Abate claim, lot 4, concession I, P. E. Hopkins reports the presence of molybdenite in a gold quartz vein.[7] The molybdenite is, however, not present in economic quantities.

Belmont Township

"Edward Shannon reported molybdenite from Peterborough county not far from Cordova Mines."[8] No further information is available in regard to this occurrence.

Big Duck Lake

In reporting on the gold deposits of Big Duck lake north of Schreiber, P. E. Hopkins says: "Much pyrite, chalcopyrite, and some pyrrhotite, galena, zinc blende, magnetite and molybdenite (?) are disseminated through the veins."[9] This is the only record that the writer has found of an association of molybdenite and galena, and as its presence was questioned by Mr. Hopkins, it is evident that molybdenite is not present in paying quantities, if at all.

Black River, Lake Superior Region

This is undoubtedly the same as the Terrace Cove locality.

[7] Ont. Bur. Mines, Vol. XXIV, Pt. I, p. 190.
[8] Ont. Bur. Mines., Vol. XII, p. 57.
[9] Ont. Bur. Mines, Vol. XXIV, Pt. I, p. 11.

Blithfield Township

On the farm of Thomas Quilty, east half of lot 29, concession I, of Blithfield, six pits have been opened up along the contact of granite and limestone, resulting in the prospecting of about 400 feet of contact. The property was examined by a company which contemplated entering upon the production of ferro-molybdenum, and the writer's information was obtained from the company's engineer. The width of the mineralized contact zone is said to be about 15 feet, and the chief mineralization seems to be on the side toward the limestone. Among the associated minerals are pyrite and pyrrhotite, and the flakes of molybdenite reach 1 inch in diameter. The mineralization is somewhat irregular.

Fig. 7—Pyroxenite carrying molybdenite, Legree mine, Brougham township.

Bromley Township

On the northwest half of lot 24, concession V, Bromley township, a deposit of molybdenite was opened during the early summer by J. E. Cole, lessee. The molybdenite is in a pyroxenite mass, and was seen at intervals for a distance of about 400 feet. Pegmatite is not prominent in the pits, but is associated with the pyroxenite, and comprises about half of the visible rock on one of the dumps. So far as development had gone, the property was low grade, but a consignment of 1½ tons of 1 per cent. ore had been shipped to the Mines Branch for a test.

Brougham Township

On lots 35 and 36, concession XIV, Legree Brothers of Dacre, have opened up a deposit of molybdenite of considerable promise. The ore body consists of a micaceous pyroxenite in gneiss. Two open cuts have been made, one on each side of a roadway. These are about 10 feet wide, and vary in depth from three to ten feet. The total length is about 70 feet. Two stock piles of concentrating ore were kept separate from the rock, and several hundred pounds of nearly pure flake was laid on one side. The writer estimated that there was about 8 tons of 3 per cent. ore in the stock piles, and about 300 pounds of the

Fig. 8—Part of ore body, Renfrew Molybdenum Mines, Brougham township.

flake. This, however, can only be considered an approximation. The property should be further developed, as this material is from the decomposed surface, and molybdite was very prominent both in the concentrating ore and in the flake. The accompanying illustration, figure 7, shows the spheroidal weathering of the ore body.

On lots 7, 8 and 9, concession XI and lot 8, concession XII of Brougham township, the Renfrew Molybdenum Mines, Limited, are engaged in mining molybdenite. The principal work is on lot 8, concession XI, on what is known as the Hunt property, and the Belgian property, the Renfrew Molybdenum Mines,

Limited, being the operating company of the Algunican Development Company. On the occasion of the writer's first visit to the property, preparations were being made to sink a shaft and put up a concentrating plant. A tunnel and cross-cut had been made in the deposit, and some diamond drilling had been done, while considerable ore had been taken from pits along the outcrop of the deposit. The molybdenite occurs associated with pyrite and pyrrhotite in pyroxenite, near the contact of the crystalline limestone and pegmatite, which has developed the peculiar structure known as graphic granite. At the time of the second visit in September a 7 by 11 foot shaft had been sunk 71 feet, and two stations made, so that a better idea of the character of the deposit was obtained. The width of the latter is not so great as appears on the surface, but is still sufficient to make a very good working body. In certain portions of the shaft, the crystalline limestone was found on both sides of the pyroxenite. The ore body has been traced on the surface for a length of about 400 feet, and at one point it is known to reach a depth of 100 feet. The general character of the pyroxenite ore body is shown in the accompanying illustration, figure 8, which shows about half the width of the ore body at this point. The richer portion of the pyroxenite is from 10 to 15 feet wide, and it is estimated that it will run about 1 per cent. MoS_2. There is, however, much of the material that will run considerably higher, but with the more recent methods of concentration it is probably not desirable to cob the better part except in the case of large flakes. The ore is to be concentrated on the spot, and the method is described more fully elsewhere in this report.

A shipment of about 16 tons was concentrated at the testing plant of the Mines Branch at Ottawa in 1915. The calculated percentage of MoS_2 was 0.84.

On lots 16 and 17, concession XI, and lot 17, concession X, Brougham township, the International Molybdenum Company was engaged in the mining of molybdenite during the summer. On the occasion of the writer's first visit in June, the manager, J. C. Murray, informed the writer that over 300 tons of ore had been shipped. This ore ran about 2 per cent. MoS_2, and was shipped to Orillia, as the company had not at that time erected their plant in Renfrew. All of the work up to the first of June had been connected with pegmatitic veins in gneiss, and the ore had been taken out from surface workings. One of the deepest pits is shown in figure 9. Pyroxenite was not observed as a prominent feature round the workings at this time, but in September considerable work had been done in connection with a mass of pyroxenite near by. The principal opening on this pyroxenite was, however, on the west half of lot 16, concession XI, on what is known as the Morin property, which was being worked on option by F. G. Todd of Montreal.

The manager of both properties at this later visit was Dixon Wilder. The pyroxenite was being quarried, and the molybdenite-bearing portion was crushed and sacked for shipment with the equipment shown in figure 10. The ore was hauled to Ashdod station, and shipped to the International Molydbenum Company at Renfrew. The quarry face is about 30 feet broad, and the deposit shows on the surface for about 75 feet, when it apparently dips under the gneiss. A shaft 27 feet deep has been sunk near this outcrop, but is not utilized at present in the mining of the ore.

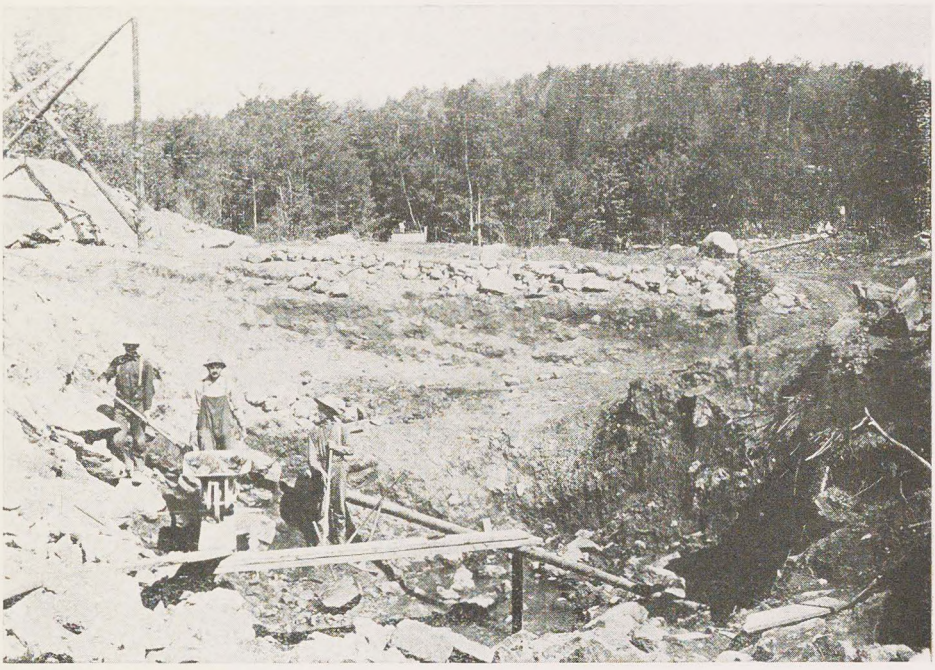


Fig. 9—Portion of the workings on lots 16 and 17, concession XI, Brougham township.

Fig. 10—Crushing and sacking ore, Morin mine.

On the property worked by the International Molybdenum Company, two shafts were sunk during the summer. One of these was 40 feet deep, and was sunk in the hope of striking the extension of the pyroxenite on the Morin property. The other was 32 feet deep, and was sunk on a pegmatite vein in gneiss. At the bottom, limestone carrying some graphite was found, but not enough of the latter to warrant mining. The presence of graphite may be looked upon as an encouraging sign, as in certain graphite mines molybdenite is found before the graphite is reached.

Molybdenite has also been found on lot 15, concession XI of Brougham township. These deposits are small, and little work has been done.

Cardiff Township

In Cardiff township there are numerous outcrops of molybdenite-bearing rock upon which development has been done. Most of these were visited by the writer, but the information gathered was rather meagre, as none of the properties were working, and water interfered with a satisfactory examination.

The most extensive work was done on lot 11, concession X or IX, on the farm of Alexander Evans. Here a 7 by 9 shaft had been sunk, and there was an open cut about 50 feet long. The rock was principally pyroxenite in gneiss, but very little molybdenite was seen, as the workings were full of water. A small mill containing a crusher and set of rolls was near the shaft, and although no information was available it would appear that the concentration consisted of crushing, rolling, and screening. Dr. Walker reports that the molybdenum-bearing portion of the rock was about one inch wide at the top of the shaft, and 20 inches wide at a depth of about 35 feet. He also states that the molybdenite occurs in large flakes.

On lot 12, concession XI, Messrs. Matthews and McMahon did some prospecting in gneiss carrying pyroxenite and pegmatite, but have discontinued work. Some of the flakes of molybdenite from this property are large, being about 6 inches in diameter, but the high grade material is not abundant. It is, however, desirable that a search be made in the vicinity of the finer grained contact phase of the pyroxenite, in which the molybdenite is likely to be more uniformly disseminated, though in fine scales.

On lot 18, concession IX, on the farm of John Mooney, molybdenite was observed in an outcrop of granite. The richer portion was about 5 feet wide, and possibly 40 feet long. No work had been done, but the molybdenite showed on the surface in scales up to one inch in diameter. It was reported late in the autumn that work had been begun on this property.

On lot 6, concession IX, on the farm of W. R. Kidd, is an open cut about 8 feet wide and 10 feet deep at the deepest portion, by about 40 feet long. The country rock is gneiss, in which there are two parallel granitoid pegmatite veins, each about a foot wide, which carry molybdenite in flakes up to an inch or more in diameter.

On lot 11, concession V, on another farm belonging to Mr. Kidd, is a similar deposit upon which a trench about 50 feet long, from 3 to 8 feet wide and 4 to 8 feet deep, has been excavated. The pegmatitic portion is in two bands, six

inches and two feet wide respectively. The ore is low grade, but easily concentrated, as the flakes are large. Mr. Kidd reported that 100 pounds of flake molybdenite was taken from this trench.

Carlow Township

In the very fine fissures, thin splashes of molybdenite (running high in molybdenum sulphide) are found, but this ore does not occur in any quantity, enough for samples only. It is stated that there is a vein of molybdenite in the neighbourhood.[10]

Conmee Township

The following description of a molybdenite property in Conmee township is given by A. H. A. Robinson[11]:

A mile or so west of Hume station, on the Canadian Northern railway, on the southwest quarter of the south half of lot B, concession III, in Conmee township, a 50-foot shaft has been sunk on an outcropping of molybdenite ore. The molybdenite is found associated with quartz in a vein striking a little north of east and traversing a dike of syenite porphyry which, in turn, cuts the green schists of the district. It is disseminated through the quartz, and sometimes the adjacent wall rock, in fine flakes and films. A little calcite also occurs with it in the vein, while iron, and possibly copper pyrites, is found disseminated in small quantities through both vein and wall rock, though more abundant in the latter.

As the shaft was full of water, and the neighboring country is drift covered, it was not possible to determine the extent of the deposit. Some seven or eight hundred feet or more to the east of the shaft, however, the porphyry dike and the quartz vein, here carrying a few scattered flakes of molybdenite, is again exposed in a small outcrop.

Digby Township

Molybdenite is reported by F. D. Adams on lot 16, concession VII,[12] but the quantity is too small to be of commercial importance.

Dungannon Township

Molybdenite is said to occur on lots 25, concessions XIII and XIV.[13] The writer visited this locality but was unable to find molybdenite, and so far as he could ascertain there had been no recent development work on these properties.

Foley Township

Small quantities of molybdenite, associated with pyrite, chalcopyrite and pyrrhotite, were found on the Big Four property, lots 32 and 33, concession V of Foley, Parry Sound district.[14] From the description the property is not rich in molybdenite.

Garrow Township

A claim was staked in 1915 by Henry Shepherd on lot 10, concession III of Garrow for molybdenite.[15] This property has not been seen by the writer.

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[10] Geo. Sur. Can., Mem. 6, p. 375.
[11] Mines Branch, Sum. Rep., 1915, p. 36.
[12] G. S. C. Ann. Rep., 1892-3, Vol. VI, N.S., p. 7J.
[13] G. S. C. Mem. 6, p. 254, and Mem. 50, 6. 116.
[14] Ont. Bur. Mines, Vol. IX, p. 167.
[15] Ont. Bur. Mines, Vol. XXV, Pt. I, p. 43.

Fig. 11—Spain mine.

Fig. 12—Spain mine.

MAP SHOWING OCCURRENCES OF MOLYBDENITE IN NORTHWESTERN ONTARIO. SCALE, 35 MILES TO THE INCH.

Graham Township or Denison Township, Sudbury Region

Dr. R. Bell mentions the occurrence of molybdenite on the Vermilion river on the line between Graham and Denison townships in quartz veins.[16] This is apparently not of an economic character.

Griffith Township

On lots 31 and 32, concession V, and lot 31, concession IV, Griffith township, is the Spain mine, which was opened up some years ago by Joseph Legree of Renfrew, and by him sold to Wm. J. Spain of New York. The workings consist of two open cuts and a 6 by 9-foot shaft which has been sunk to a depth of 50 feet. At the time of the writer's visit, the entire mining work was confined to one of the open cuts, and the working face is shown in figures 11 and 12. The molybdenite is practically confined to pyroxenite and pegmatite, but is more abundant with the pyroxene. At this particular place the molybdenite is in extremely large flakes and masses, some of which are over a foot in diameter. The working face of the open cut is from 12 to 15 feet high and about 40 feet long. The ore, however, occupies only about half of this width, the mineralized portions being separated by a band of gneiss about 12 feet wide. In figure 12 this gneiss is shown as the prominent feature, the men at the left being almost under the contact between the gneiss and the pyroxene rock, while the trench at the right is in a pyroxene pegmatite mass which, although not so rich in molybdenite as that to the left, is still in good concentrating ore. At the time of the first visit, no concentration was being carried on, but flake molybdenite was being cobbed out from the higher grade ore, and several thousand pounds had been extracted in this way. The mill, which is described in another part of the report, was nearing completion, and the lower grade ore was being reserved for treatment. The country rock at the Spain mine is gneiss, which lies in a nearly horizontal position, and is overlain by a crystalline limestone containing much mica as well as some pyroxene. Some two or three hundred feet in a westerly direction from this pit, another small pit is located in a fine grained pyroxenite, in which the molybdenite occurs as minute scales. This, however, was stated by the manager to be of sufficiently high grade to pay for concentrating.

Gull Lake, Near Dryden

The description of the deposit on Gull lake is furnished by E. Thomson.

This property is situated at a point about one mile due south of the extreme eastern end of Gull lake, a large lake about 15 or 16 miles northeast of Dryden. The molybdenite occurs in a pegmatite dyke, which strikes east and west, with a maximum width of about 6 feet and a total length of 50 feet, and consists almost entirely of quartz and orthoclase, but contains as well subordinate quantities of molybdenite, muscovite, and biotite. This pegmatite dike is intruded in a hornblende schist, which also strikes east and west, similarly to the schist found in the immediate vicinity of Dryden. A small test pit has been sunk on this dike to a depth of about 3 feet, all of the specimens of molybdenite obtained from this locality coming from this pit. Various other pegmatite dikes intrude in the

[16] Geol. Sur. Can., Ann. Rep., 1889-91, Vol. V, N.S., p. 25F.

schist at different points along the same outcrop, some following the strike of the schist, others cutting across it, but these carry no more than a few odd flakes of molybdenite of very small dimensions. The property was visited under the guidance of C. Coates of Dryden, one of the first discoverers of it.

Gull River

Alex. Murray reports the occurrence of molybdenite from the Gull river above Mud Turtle lake.[17] This location may be in Lutterworth township, but is not definitely located.

Fig. 13—Open cut, Harcourt township.

Harcourt Township

In the fall of 1901 mining work was carried on by the Land and Immigration Company, Limited, of Haliburton on lots 2 and 3, concession I of Harcourt township under the direction of S. Dillon Mills, who furnished an excellent description of the deposit for the eleventh report of the Bureau of Mines. Since that time little work has been done. The principal development work consists of an open cut about 50 feet long, 6 feet wide and at its deepest place from 15 to 20 feet deep. This opening is shown in figure 13. Continuing along this outcrop, a shaft about 6 by 8 feet was sunk to a depth of 15 feet. Very little molybdenite was seen either on the dump or on the walls of these openings.

[17] Geol. Sur. Can., Rep. Prog., 1852-3, p. 145.

A few hundred feet to the south a small excavation from which about forty tons of rock had been removed showed the only encouraging quantity of molybdenite.

The writer estimated the quantity of high grade material that had been laid to one side to be one or two tons. The material was of exceptionally high grade, and came from a nodular mass in the pyroxenite. This property should be further developed, as with the improvements that have been introduced in the concentration of molybdenite, it would be desirable to have a mill run to ascertain the value of the property. It is almost impossible to take a representative sample, as some of the ore is extremely rich, while the rest is poor, but the writer estimates the rich material on the stock pile to be a 10 per cent. ore.

Ignace

Samples of molybdenite in granitic rock were shown the writer in April, 1917, which were said to have been found near Ignace. The flake is small, but other sulphides were absent.

Kirkland Lake

At the Tough-Oakes mine and other mines in this district, molybdenite is found in some abundance, though usually as a thin film. The veins are said to carry quartz, pyrite, chalcopyrite, galena, sphalerite, calcite, ankerite and dolomite.[18] The presence of galena is unusual, but has also been noted at Big Duck lake, north of Lake Superior.

Lake of the Woods Region

On Quarry island near the Sultana gold mine, veinules carrying molybdenite are reported by Lawson.[19]

The writer was informed some years ago that the ore of the Sultana mine carried some molybdenite. It was also seen by the writer in the vein at the Mikado mine, and on mining location D. 149 in Bag bay of Shoal lake.[20] None of these occurrences, however, are rich enough in molybdenite to be used as a source of this material.

Laxton and Somerville Townships

On the shores of Mud turtle lake in the above townships are several localities where molybdenite has been found. It was first mentioned by Alexander Murray[21] who describes the occurrence as follows:

> The white crystalline limestones north of Balsam lake are intersected by huge veins of white quartz, in one of which small masses of sulphuret of molybdenum were found, on a small island in Big Mud Turtle lake; it occurs disseminated in the vein, accompanied by greenish scapolite, green cleavable pyroxene, sometimes assuming a radiated form, and iron pyrites, which is abundantly disseminated in some parts. Specimens were shown to me by an Indian on the same lake, apparently of the same character as those procured by myself, which he stated had been found a few miles higher up the Gull river.

On the north shore of the lake is a deposit upon which work was done many years ago, and a few flakes of molybdenite were still visible. The lessee, Mr. T. Horscroft, was considering further prospecting.

[18] Ont. Bur. Mines, Vol. XXIII, 1914, Pt. II, p. 21.
[19] Geol. Sur. Can., Ann. Rep., 1885, Vol. I, N.S., p. 144 C C.
[20] Ont. Bur. Mines, Vol. XX, 1911, Pt. I, p. 176.
[21] Geol. Sur. Can., Rep. Prog., 1852-3, p. 144-5.

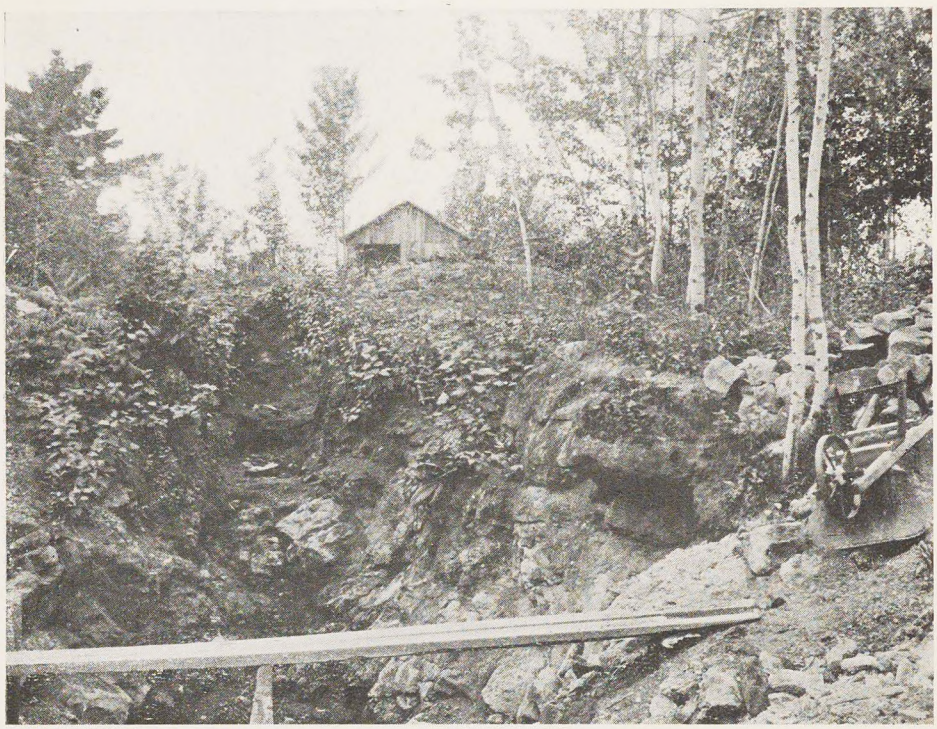


Fig. 14—Trench, Horscroft mine, Laxton township.

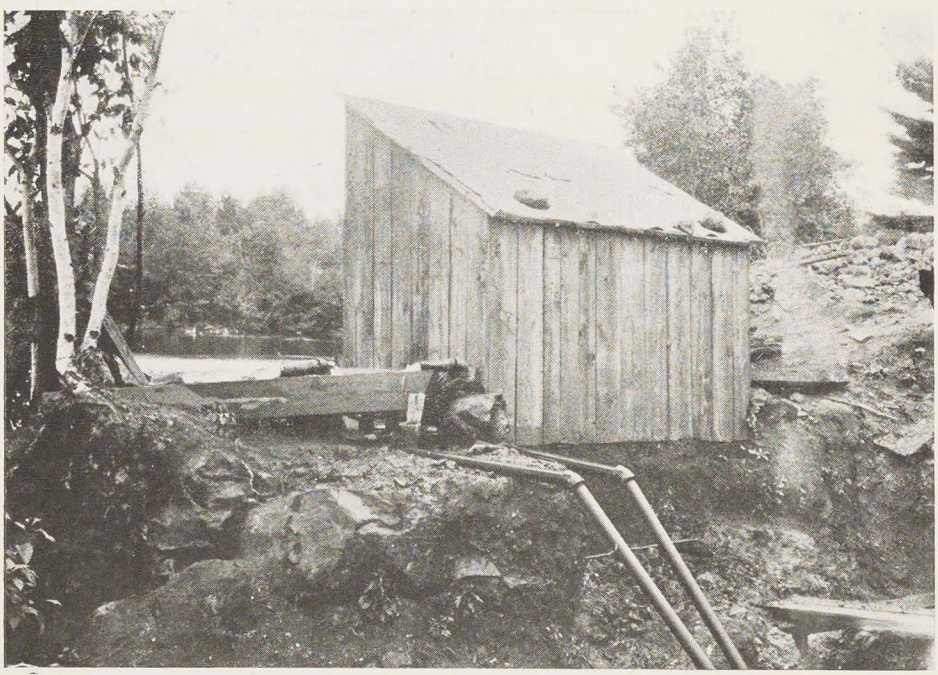


Fig. 15—Pump house, Horscroft mine, Laxton township.

On the west shore of the lake are two mines which from the nature of the case must be discussed together. One is near the water's edge on lot 5, concession XI, Laxton township, and the other is the water lot adjoining.

The mine on the mainland is on the farm of William Adair, and is being worked under lease by T. Horscroft. The property was visited early in May at which time a pit about 12 feet in diameter had been opened up, and a small quantity of molybdenite taken out. The pit was, however, filled with water so that it could not be examined. Mr. Horscroft showed one or two other outcrops of pegmatite which exhibited a few flakes of molybdenite. A second visit in September found the property in better condition for examination, inasmuch as a trench had been extended from the above-mentioned pit for a distance of about 70 feet. The trench was principally in soil and a decomposed pyroxenite, in which considerable molybdenite was present. The pyroxenite was also charac-

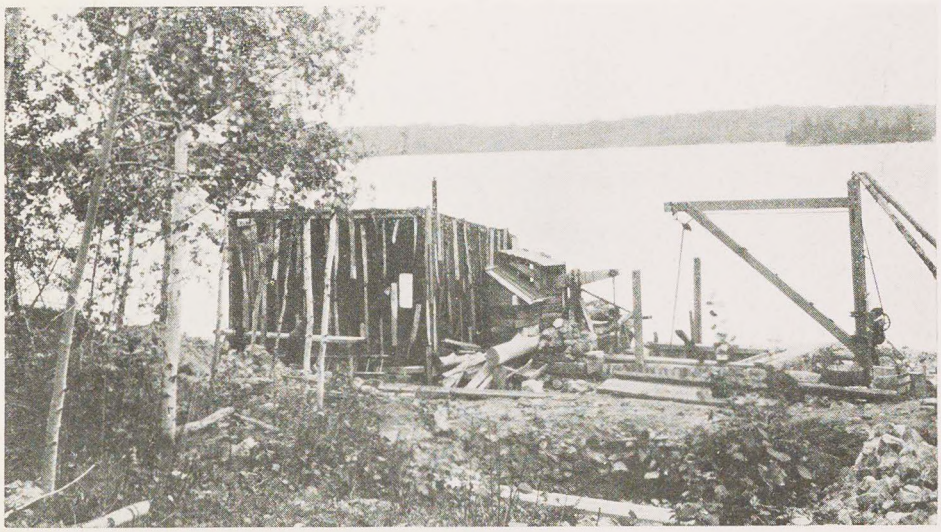


Fig. 16—Russell-Ponton mine, Laxton township.

terized by the presence of molybdic ochre or molybdite, which has resulted from the oxidation of molybdenite. The ore body as exposed by this trenching and the pit, is about 75 feet by 20 feet by 10 feet, and would possibly run from 0.3 to 0.6 per cent., MoS_2, but could be easily cobbed to yield a higher grade. Mr. Horscroft reported that he shipped two carloads to the Mines Branch at Ottawa during the summer which carried 2.38 per cent. and 1.08 per cent. MoS_2 respectively.

The trench from which most of this material was taken is shown in figure 14, while the pump-house for de-watering the main pit is shown in figure 15. Two gasoline pumps are used for the pumping.

Adjoining the last mentioned property is the mine which has been sunk by Douglas Ponton and A. J. H. Russell. The general layout of the surface plant is shown in the accompanying view (Fig. 16) which shows the boiler house with the beam of a Cornish pump just at the left of the shaft, while at the right

is a hand derrick; in the foreground is the pit on the Horscroft property as it appeared in May. The shaft, the top of which is shown in the picture, is said to be 50 feet deep and is 7 by 9 feet. Unfortunately, on the occasion of both visits this was full of water, so that the only information concerning the ore body had to be secured by an examination of the stock piles. The ore consists principally of a micaceous pyroxenite, portions of which are of extremely high grade. Several tons of concentrating ore was seen on the stock pile, and considerable high grade material was in the store house. The writer was informed that since his last visit the mine has been pumped out with a view to continuing work.

In addition to the known deposits of molybdenite in this township, the writer observed one or two outcrops on the road between Norland and Coboconk that seemed to furnish the proper association for molybdenite, though unfortunately none of this material was visible. These were contact zones between crystalline limestone and underlying granitic rocks where pyroxene and brown mica were abundant.

Lac Seul

The presence of molybdenite on Lac Seul is reported by Dr. Coleman,[22] who received his information from the manager of the Hudson Bay post.

Longuelac

Samples of molybdenite obtained from a pegmatite near Longuelac were shown at Port Arthur in April, 1917. No information as to the size of the deposit was obtainable. The flakes were large, some being an inch or more across, and the ore appeared to be free from other sulphides.

Lutterworth Township

On lot 7 or 8, concession II, township of Lutterworth, A. Y. Hopkins of Kinmount has opened up a quartz vein containing a little molybdenite. At no place was the vein more than three feet wide, and the molybdenite was not a striking feature of either the material in the vein or of that which had been removed. This vein is in gneiss a short distance from the shore of Davis lake, and is probably not the principal carrier of molybdenite at this locality. A short distance to the west of the vein there is an outcrop of pegmatitic granite, the borders of which are concealed, and in view of the common occurrence of molybdenite on the margins of such masses it is highly probable that prospecting on this margin would result in a further discovery of molybdenite. There is also some molybdenite on a small island a few hundred feet from the shore, but although specks could be seen, the water was over the outcrop and no idea of the importance of the deposit could be obtained.

On lot 7, concession X of the same township, there are two narrow veins carrying molybdenite. The writer did not visit the locality, as no work had been done for years, and the descriptions of the property would indicate that it is not commercially important. This may be the Gull river locality mentioned by Murray.

[22] Ont. Bur. Mines, Vol. V, 1895, p. 61.

Lyndoch Township

On lots 5 and 6, concession VIII of Lyndoch township is the Jamieson mine, which was opened up in 1907 by the late R. A. Jamieson of Renfrew. On the occasion of the writer's visit in June, work had been discontinued and the workings were in the condition shown in the accompanying illustration, figure 17. The workings consist of two pits connected by an open trench and about midway between the pits is an inclined shaft as shown in the figure. As is evident from the illustration, very little of the ore body could be examined, as much of it was covered with water, with which the shaft was also filled. The pit shown is the north pit, and the ore body is about six feet wide, lying between gneiss and crystalline limestone, the latter being also in contact with gneiss on

Fig. 17—Jamieson mine. The letters signify respectively limestone, ore and gneiss

the other side, though the immediate contact was not seen. The ore body consists of pyroxenite and pegmatite containing large crystalline flakes of molybdenite, together with a considerable quantity of pyrite and pyrrhotite, making an exceptionally good ore for concentration, as the molybdenite flakes are generally more than a half inch in diameter and can be largely recovered by crushing and screening. The ore which had been exposed on the dump had disintegrated considerably, resulting in the breaking down of the pyroxene, and rendering the ore very friable. In this process of disintegration, the molybdenite is oxidized, and some molybdite formed. The pyrrhotite also undergoes a change, taking on a purple tarnish which is probably due to a thin film of ilsemannite, or possibly some unidentified compound of iron and molybdenum. This property was worked on lease during the winter of 1915-16 by the Orillia Molybdenum Mines, Limited. There were

lying near the blacksmith shop 57 sacks of low grade ore ready for shipment, and in addition there were some other small heaps of concentrating ore which had been prepared for shipment. During the period when the last work was carried on about 285 tons of ore, containing approximately 12,760 pounds of pure molybdenite were taken from this mine.[23] The buildings at the mine proper consist of a blacksmith shop and powder house. The mining camp is situated in the valley at the foot of the mountain upon which the mine is located, and comprises a sleeping house, dining camp, office, storehouse and stable, these quarters being well built and very comfortable.

To the southwest of this property, it is reported that the Orillia Molybdenum Mines have staked a claim called Lybdock, but the writer was unaware of this at the time of his visit, and consequently did not examine it.

Manitou Lake Region

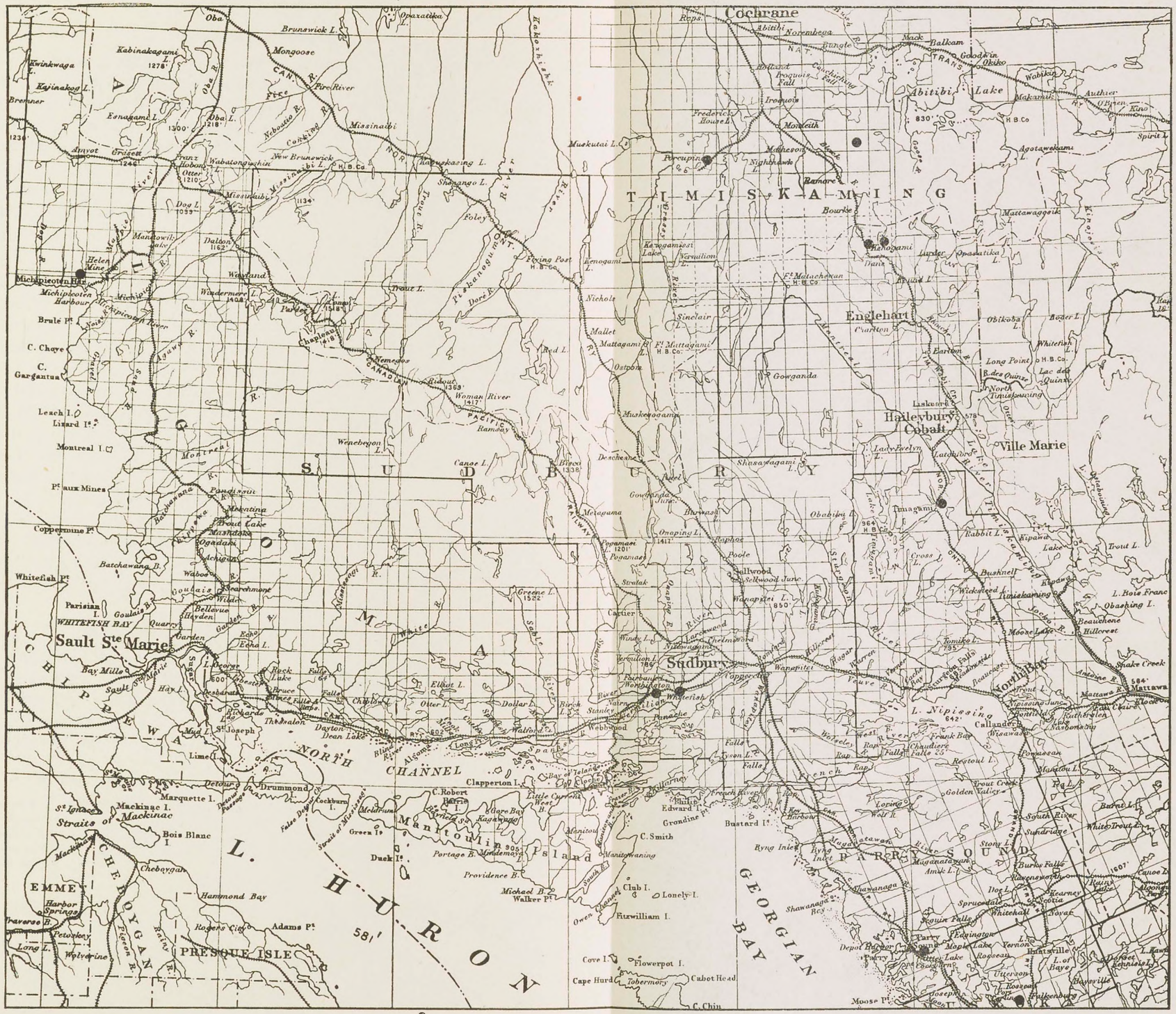
The description of the molybdenite vein on claim A.D. 8 is furnished by E. Thomson:

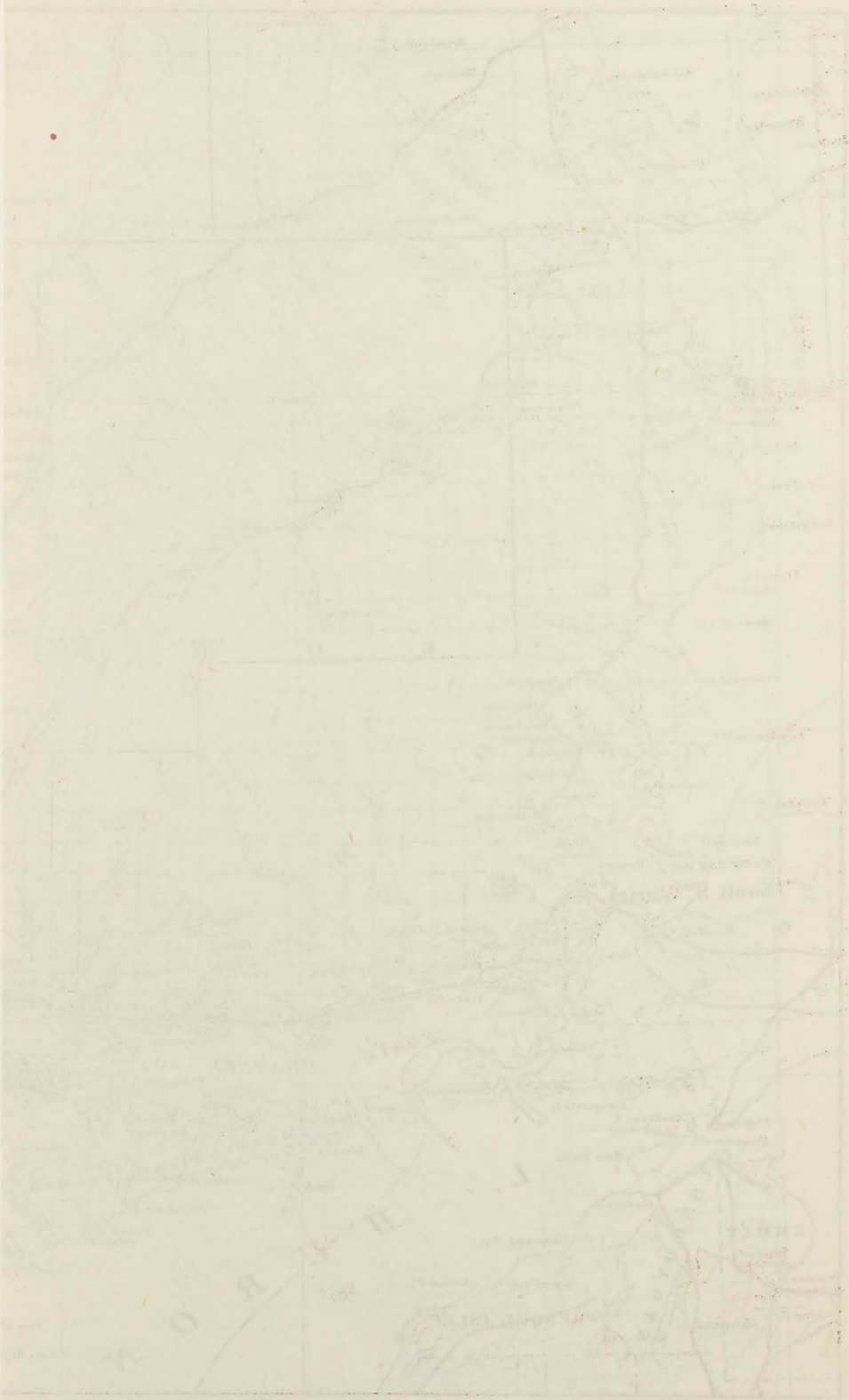
This property is the old mining claim A. D. 8., situated on a small lake west of Upper Manitou lake, about six or seven miles from the former village of Gold Rock, on that lake. The discovery post of the claim, which has been restaked within the last year by E. D. G. Pidgeon, of Wabigoon, is 14 chains from the northeast corner of the claim on a bearing of S. 21° W. The molybdenite occurs in a very quartzose pegmatite dike, striking about northeast, and with a width at both ends of 10 to 12 feet, and a total length of about 250 feet. This dike consists almost entirely of quartz, which in some places is green in colour, but contains as well lesser amounts of chlorite, orthoclase, molybdenite, bismuthinite, and green and bronze-coloured mica. The molybdenite occurs in intimate association with the chlorite, which is in the form of masses in the middle of the dike. These clumps of chlorite, in all probability, are altered horses of the country rock. This dike outcrops over the summit of a hill about 30 feet in height, at the top of which it separates into two stringers about two feet wide. The outcrop of the dike is best seen at both ends, where it shows its full width of 10 to 12 feet on the sides of this hill. The dike is somewhat more pegmatitic at the southwest end than elsewhere. The neighbouring rock is very basic, consisting almost entirely of hornblende, and is apparently a highly altered pyroxenite. This rock changes to a diorite about 100 feet to the east, which again gives way in a few hundred yards further east to a porphyritic quartz diorite. This last rock is apparently part of the Laurentian granite mass which forms the bulk of the rock in the locality. The property was visited in company with the owner, Mr. Pidgeon.

March Township

On lot 6, concession II, March township, a pit was dug about twenty years ago. This location was not visited by the writer, as he was informed by men who had looked it over with a view to opening it up, that it was not of an economic character. It was visited in June, 1910, by Dr. T. L. Walker, whose report is also unfavourable.[24]

[23] Mines Branch Summary Report, 1915, p. 82.
[24] Mines Branch, Bull. 93, p. 44.


Cochrane
Abitibi
Lake
TIMISKAMING
Englehart
Haileybury
Cobalt
Ville Marie
Sudbury
Sault Ste Marie
L. HURON
GEORGIAN BAY
NORTH CHANNEL
Manitoulin Island
PRESQUE ISLE
CHEBOYGAN
EMMET
Mackinac
Straits of Mackinac
Parry Sound
Lake Nipissing
Timagami
Temiskaming
Mattawa
Callander
Trout Lake
Whitefish Bay
Batchawana Bay
Michipicoten Harbour
Michipicoten River
Missinaibi River
Mattagami River
Montreal River
Spanish River
Wanapitei L.
Ramsay
Foley
Dalton
Dog L.
Windermere L.
Chapleau
Nemegos
Ridout
Woman River
Canoe L.
Deschenaux
Shaw-Agami L.
Gowganda
Muskego-gamog
Onaping L.
Poapaonais
Stralak
Cartier
Wanapitei L.
Wahnapitei
Fairbanks
Worthington
Nickel
Copper
Wanup
Wahnapitei
Larchwood
Chelmsford
Nitkiwaning
Windy L.
Vermilion L.
Vermilion
Kawagamiest Lake
Vermilion L.
Kenogami L.
Nichols
Mallet
Ostrom
Red L.
Sinclair
Fr Mattagami
Fr Matachewan
Fr Matachewan H.B.Co
Fr Mattagami H.B.Co
Porcupine
Muskutai L.
Frederick House L.
Iroquois
Mordeith
Matheson
Nighthawk L.
Ramore
Bourke
Dana
Lucas
Opasatika L.
Mattawaggeik
Agostawekami L.
Spirit L.
Kinogami
Obikoba L.
Boyer L.
Whitefish L.
Long Point
Lac des Quinze
R. des Quinze
North Timiskaming
Earlton
Charlton
Lady Evelyn L.
Latchford
Rabbit L.
Kipawa
Lake
Trout L.
Bushnell
Wicksteed L.
Timiskaming
L. Bois Franc
Obashing L.
Beauchene
Hillcrest
Moose Lake
Tomiko L.
Shake Creek
Jocko R.
Obabika L.
Obabika
Burwash
Onaping
Raphoe
Poole
Sellwood
Sellwood Junc
Cross L.
Stanley
Timagami
Timagami L.
Lake Temiskaming
Mattawa R.
Mattawa
Nipissing Junc
Northfield
Ruth Siblen
Nasbonaing
Wiasawa
Callander
Pomassan
Restoul L.
Marion L.
Golden Valley
Trout Creek
Burnt L.
South River
Sundridge
White Trout L.
Stone L.
Burke Falls
Ravenswood
Canoe L.
Bloom Port
Hearney
Scotia
Whitehall
Sprucedale
Seguin Falls
Parry Sound
Depot Harbor
Edgington
Maple Lake
Vernon
Rosseau
Utterson
Huntsville
L. of Bays
Bracebridge
Falkenburg
Rosseau
Joseph
Moose Pt
Bustard Is
Ryng Inlet
Magnetawan
Amik L.
Shawanaga
Shawanaga Res
Key Harbour
Wolf R
Loring
Grondine Pt
Philip Edward I.
French River
Little Current
West B.
Clapperton I.
Bay of Islands
Fitzwilliam I.
Club I.
Lonely I.
Michael B.
Walker Pt
Providence B.
Portage B.
Manitowaning
Kagawong
Moore Bay
Meldrum
Green Is
Duck Is
C. Smith
C. Robert
Harris I.
Rockburn I.
Drummond
Marquette I.
Detour
Detour Passage
Bois Blanc I
Cheboygan
Hammond Bay
Rogers City
Adams Pt
Petoskey
Harbor Springs
Traverse B.
Long L.
Wolverine
Pigeon R.
Cove I.
Flowerpot I.
Cape Hurd
Tobermory
Cabot Head
C. Chin
Mississagi R.
Serpent R.
Blind R.
Aux Sables R.
Garden R.
Echo L.
Bay Mills
Hay L.
Mud L.
St Joseph I.
Lime I.
Dayton
Dean Lake
Thessalon
Richards
Bruce Mines
Algoma
Elliot L.
Otter L.
Dollar L.
Webwood
Birch L.
Spanish R.
Chutes
Falls
Rapids
Whitefish Pt
Parisian I.
Goulais R.
Goulais Bay
Searchmont
Wilson
Bellevue
Hayden
Quarry
Garden R.
Batchawana B.
Agawa R.
Agawa
Montreal I.
Leach I.
Lizard Is.
C. Gargantua
C. Chove
Brule Pt
Pt aux Mines
Coppermine Pt
Mississagi
Ogadaki
Achigan
Wabos
Manitaka
Trout Lake
Pandissaut
Mesanting
Batchawana
Windermere L.
Parker L.
Chapleau
Nemegos
Ridout
Woman River
Ramsay
Canadian Pacific Railway
Wenebegon L.
Wenebegon R.
Montreal R.
Pic R.
Michipicoten R.
Dog L.
Dalton
Missinaibi R.
Mattagami R.
Dore R.
Flaskenaquinin R.
Foley
Nemegos



Matawatchan Township

On the farm of James Wilson, lot 3, concession VI, is a large mass of pyroxenite in which molybdenite has been found. Mr. Wilson was not at home, but his son guided the writer to the outcrop. A mass about six feet square by about 15 inches thick had been removed and broken up. In this mass were small scales of molybdenite up to one-half inch in diameter. The pyroxenite is on the margin of a large pegmatite mass, and is from 40 to 50 feet wide. Nothing definite can be said concerning values on the showing that has been made, but it is highly desirable that further prospecting be done, possibly nearer the borders of the pyroxenite.

Miller Township

On lot 5, southwest of the Frontenac road, Miller township, some work has been done by G. C. Shannon of Kingston on the farm of Thomas Armstrong. Mr. Shannon is the owner of the deposit. The workings are on a pegmatite dike cutting gneiss and varying in width from six to eight feet. Three pits have been opened up which are connected by a trench through the surface soil. The more westerly pit is about 12 feet square and was filled with water. The middle pit is about 30 feet long and about 10 feet deep at the deepest portion, while the more easterly one has about the same dimensions as the middle one. Molybdenite was seen in the second and third pits, and a small amount of possibly 1 per cent. ore was laid to one side.

On lot 5, northwest range, the property of John R. Kring, T. L. Walker reports that molybdenite occurs in pegmatite. The association is almost identical with that described above, but this property was not visited by the writer.

Molybdenite has been reported by R. A. A. Johnston[25] on lot 3, concession VIII, but no work has been done, as far as the writer was able to ascertain, for several years.

Molybdenite Lake, Near Michipicoten Harbour

Although this is probably the third locality at which molybdenite was found in Canada, practically nothing is known about either the size or character of the deposit. The first mention of it was made by Sir W. E. Logan who in discussing molybdenite localities says: "Specimens from a third locality were sent me from the River Doré."[26]

Dr. J. M. Bell says:

> A deposit of molybdenite is found in a coarse-grained quartzose pegmatite on the shores of Molybdenite lake on the route between Michipicoten harbour and the Frances mine. I was unable to visit the locality during the summer, but I understand that the deposit is not of commercial importance, as proven by some exploration work done on the property some years ago.[27]

Monck Township

On lot 12, concession VIII of Monck Township near Falkenburg station, about three miles north of Bracebridge, molybdenite has been found in gneiss on the farm of Thomas Stead. Two openings have been made in the gneiss, and

[25] Mineral Resources of Canada, Bulletin on Molybdenum and Tungsten, 1904, p. 9.
[26] Geol. Sur. Can., Rep. Prog., 1853-54-55-56, p. 40.
[27] Ont. Bur. Mines, Vol. XIV, 1905, Pt. I, p. 354.

Fig. 18—Ore sacked for shipment, lot 11, concession XV, Monmouth township.

Fig. 19—Molybdenite quarry, lot 13, concession XIII, Monmouth township.

small flakes of molybdenite are to be seen, particularly in the quartzose portions. Except in the material that had been taken out from these openings, no molybdenite was observed, and the quantity that was visible would hardly appear to be of economic value. It is possible, however, that with further development a higher grade body might be disclosed.

Monmouth Township

On lot 11, concession XV, a pit was opened up during the latter part of the past summer by George Padwell in a weathered pyroxenite at the contact of granite and limestone. Figure 18 shows the ore taken from the pit and sacked for shipment. In addition to the ore in the sacks about an equal quantity was in a pile near by to be cobbed and sacked. This ore would probably run from 1½ to 2 per cent. MoS_2. Most of the work done in securing the ore consisted of stripping and taking out loose rock, but drilling had been begun in the less decomposed rock.

On lot 13, concession XIII, Mr. Padwell was engaged during the summer in quarrying the outcrop of pyroxenite shown in figure 19. The quarry face is about 40 to 50 feet long and about 10 feet high, and is entirely in a hard pyroxenite which is in contact with granite. The pyroxenite was traced for about 200 feet. About 15 tons of concentrating ore which would probably run from 1 to 1½ per cent. MoS_2 was set aside in a stock pile.

Mr. Padwell informed the writer that he had shipped a ton of flake molybdenite to the Mines Branch in addition to the material on hand.

A deposit was opened up about a quarter of a mile west of Wilberforce by P. J. Dwyer and associates during the winter of 1916-17, and 25 tons of ore was shipped. The ore as shipped yielded .369 per cent. molybdenite.

Monteagle Township

Molybdenite is reported from lots 26 and 27, concession VI of Monteagle.[28] This locality was examined by the writer without finding any molybdenite. It was also examined by Dr. Walker in 1910 with the same result.

On lot 6, concession I, molybdenite is reported in a quartz vein, but not in economic quantities.[29] This property was not visited by the writer.

At the mine of the National Graphite Company, Limited, near Maynooth, a small quantity of molybdenite has been found. The manager, Ralph Foster, kindly showed the writer over his property, and informed him that in sinking for graphite, molybdenite was usually encountered before the graphite was found, and that the presence of molybdenite is looked upon by the miners at this place as an indication that graphite is near at hand. The molybdenite occurs in a bright, hard pyroxenite, which is rather fine in grain and contains considerable pyrrhotite.

[28] Geol. Sur. Can., Mem. 6, p. 351.
[29] Ibid.

Net Lake

About four miles north of Timagami station on the Timiskaming and Northern Ontario railway and about a quarter of a mile east of the track, a deposit of molybdenite was opened up about ten years ago. The main ore body, upon which a shaft has been sunk, is about fifty feet wide, and consists of a series of gash veins of quartz carrying chalcopyrite and molybdenite in greenstone. The molybdenite is present in radiating nodules which when broken across give the appearance of a rosette.

The shaft is said to be about 50 feet deep, and about 200 tons of rock and ore are upon the dump. The molybdenite is well distributed in the quartz, and although it did not appear to be rich when compared with other ores, the nodular character of the molybdenite renders the appearance somewhat deceptive, and it is probably richer than it appears to be. The writer would estimate that about one-fifth of the dump consisted of quartz which would run 1 per cent MoS_2.

Fig. 20—Head frame and dump, Net lake molybdenite mine.

Openings were seen in two other places on the property where the veins, although of high grade, are not more than a foot wide. At the time when the work was done good camps were erected. Some of these have, however, been burned, but the boiler house is in fairly good shape, and is provided with hoist and pump. A view of the head frame and dump is given in figure 20.

North Crosby Township

On lot 14, concession V, two pits were opened up many years ago, and molybdenite was found associated with granite or syenite, crystalline limestone, and a dark greenish rock largely made up of pyroxene and scapolite. Dr. Walker

visited this locality and reported that it did not appear to be of economic importance.[30]

Olden Township

G. M. Macdonnell of Kingston, worked a deposit on the south half of lot 7, concession VI, Olden township, and shipped 238 lbs. of molybdenite ore in 1916 from Mountain Grove to the Mines Branch, Ottawa, for treatment. The ore is described by C. S. Parsons[31] who says: "The molybdenite was associated with a gangue consisting chiefly of pink feldspar and pyroxene. Very little pyrite and no mica was observed in the sample." The exact location from which this was derived is not mentioned.

Porcupine Region

Wm. C. Offer shipped 140 lbs. of flake molybdenite and 775 lbs. of concentrating ore to the Mines Branch. The exact location of Mr. Offer's property is not known to the writer.

Raglan Township

On lot 27, in concessions IX and X, three pits have been sunk, and molybdenite was seen on two of the dumps. The best showing is at the pit which is on or near the line between the two properties, and is claimed by the owners of the respective lots. From 30 to 40 tons of rock was taken from this pit, and possibly a ton of 2 to 3 per cent. ore lies on the dump. The ore comes in a pegmatite dike in crystalline limestone, about four feet wide. The other two pits are on concession IX, and although the rock on the dump beside one of these showed molybdenite, none was observed on the walls of the pit. Mr. John Windle owns lot 27, concession IX, and Mr. Herman Liedke lot 27, concession X.

Craigmont

The presence of molybdenite at the corundum mines is recorded by W. L. Goodwin[32] and by A. E. Barlow.[33] From a perusal of the reports the deposit does not appear to be of economic importance for molybdenite.

Rainy Lake

Lawson mentions the occurrence of a quartz vein carrying molybdenite at the contact of the Laurentian and Couchiching at Bear's passage on Rainy lake,[34] but says nothing to encourage the hope that it is of economic character.

Roberts Township

John Mataris staked a claim for molybdenite in Roberts township in 1915.[35]

[30] Mines Branch, Bull. 93, p. 45.
[31] Mines Branch Summary Report, 1915, p. 117.
[32] Ont. Bur. Mines, Vol. XV, 1906, Ann. Rep., Pt. I, p. 43.
[33] G. S. C. Mem. 50, p. 88.
[34] Geol. Sur. Can., Ann. Rep., 1887-88, Vol. III, N.S., p. 180F.
[35] Ont. Bur. Mines, Vol. XXV, 1916, Pt. I, p. 44.

Ross Township

On the farm of John Rose, lot 22, concession II of Ross township, near Haley station on the Canadian Pacific railway, an open cut has been made on a coarse grained pegmatite dike in gneiss. The dike is from two to four feet wide, but the portion that showed molybdenite was under water, so that the estimate of value had to be made on the material on the dump, as the extension of the dike beyond the excavation was not observed to carry molybdenite. The opening is about fifty feet long and from two to eight feet wide, with a depth exceeding six feet in places. The writer estimated that there was about one hundred tons of rock on the dump and about two tons of concentrating ore which he estimated at 1 per cent. MoS_2. Dr. Walker took a sample from this dump and obtained 1.61 per cent. MoS_2, so that the concentrating ore would probably run between one and two per cent. The writer was informed that 10 tons assaying 3.64 per cent. MoS_2 was shipped this season from this property.

On the west half of lot 7, concession IX of Ross township, some excavations were made a few years ago. The writer did not visit this property, as no recent work has been done, and the last published report by Dr. Walker indicated that little could be done.

Sebastopol Township

On the farm of Edward Ziebarth, lots 36, 37 and 38, Range C, South, are two small dikes in gneiss and crystalline limestone in which some molybdenite has been found, but the development up to date has not exposed a deposit of commercial importance. The width of the dikes is about two feet and 18 inches respectively, and they consist of pyritic pyroxenite and pegmatite.

Sheffield Township

On lot 5, concession XIV of this township is located the Chisholm mine, which was worked under option during the spring and early summer by the International Molybdenum Company, with J. F. McKenzie as manager. Nine men were employed in mining operations under what appeared to be very favourable conditions, as the deposit is a flat-lying body of crystalline limestone containing large masses of pyrite, pyrrhotite, hornblende, scapolite, phlogopite and molybdenite, which permitted of open quarry work. At a short distance gneiss was seen, so that although the contact of the two formations was not observed, there is no doubt that it is a typical contact deposit. Two pits had been opened up, and a large body drilled preparatory to blasting. The extent of the work is indicated in figure 21 which shows the larger pit that was opened near the boiler house. Old stock piles were also being removed after preliminary cobbing. At first glance these piles appeared to be rich copper ores carrying molybdenite, as the purple colour so characteristic of bornite and the deep brass yellow of chalcopyrite were very prominent. Instead of being an indication of copper, however, this is probably to be looked upon as an indication of molybdenum, as these minerals proved to be pyrrhotite and pyrite respectively. So far as the writer is aware, this iridescent tarnish of pyrrhotite and pyrite has not been mentioned by any other writer. It is an important point to keep in mind in prospecting for molybdenite, for although the film is too thin to make a satisfactory chemical

examination it probably consists of ilsemannite. Over 200 tons of ore was shipped to Orillia and there concentrated in 1916.

On the farm of Timothy Dwyer, lot 8, concession XV, a pit has been opened up about 8 by 10 feet and ten feet deep, in crystalline limestone. A few flakes of molybdenite were seen which were associated with pyrite, quartz and tourmaline. Pyroxene was not prominent at this pit, though it was present in small quantities. This property was not being worked at the time.

Another deposit was opened up on the farm of Matthew Spratt, lot 8, concession XV, by L. L. Cailloux, but work had been discontinued. An open cut about 10 feet wide by 20 feet long and more than 10 feet deep had been excavated. The bottom of this trench was filled with water, and it was not possible to make a thorough examination. Very little molybdenite was to be seen on the walls of the

Fig. 21—Chisholm mine, pit near boiler house.

cut, but a small stock pile nearby contained a ton or two of low grade ore. The minerals associated with the molybdenite were pyrite, quartz, tourmaline, pyroxene, calcite and dolomite.

On lot 15, concession XVI, on the farm of William Wager, the presence of molybdenite is reported, but the deposit was not seen by the writer.

Five open cuts have been excavated on the farm of A. Kellar, lot 12, concession XIII by O'Brien's-Greenfield of Superior, Wisconsin. At the time of the writer's visit five men were working, and about 160 pounds of pure flake molybdenite had been taken out. The deposits are pegmatite dikes in gneiss, and the molybdenite is principally confined to quartz stringers in the pegmatite. Orthoclase, pyrite, calcite and quartz are the associated minerals of prominence. The work done so far may be looked upon as prospecting, so that the quantity of flake molybdenite saved may be considered encouraging.

Smooth Rock Lake (Manitou Region)

The writer has described the occurrence of molybdenite from two localities on this lake, one in a gold quartz vein, the other as a constituent of trap rock.[36] Neither of the occurrences is of economic importance.

Somerville Township

(*See* Laxton and Somerville.)

Steep Rock Lake

The presence of molybdenite is reported from the vicinity of Steep Rock lake by H. H. Wood, who has a claim on a small lake just over a portage 12 chains long from Steep Rock lake. This small lake is located approximately at N. 48° 49′, W. 91° 35′. From Mr. Wood's description the deposit is a quartz vein in chlorite schist at or near the contact with granite. There has not yet been sufficient development to enable a judgment to be formed as to the value of the property.

Swastika

Molybdenite is reported from the Lucky Cross mine.[37]

Talon Chute

The occurrence of molybdenite has been reported from near Talon Chute, about 25 miles east of North Bay. Dr. Walker, however, visited this locality, and found graphite but not molybdenite.[38] So far as the writer has been able to learn, none of those reporting this occurrence state that they saw one in place.

Tamarack Lake

In July, 1917, while examining the area northwest of Lake Nipigon for the Ontario Bureau of Mines, P. E. Hopkins found a large rusty pegmatite dike containing a little disseminated molybdenite. The location of this occurrence is at the extreme north end of Tamarack lake, or about three miles southeast of Smooth Rock lake, district of Thunder Bay.

Terrace Cove

This locality, although not visited by the writer, is worthy of special mention, as it is the first place at which molybdenite was found in Canada,[39] specimens of which were sent by the Geological Survey of Canada to the Exhibition of the Industry of All Nations in London[40] in 1851. A description of the deposits is given by Sir W. E. Logan[41] as follows:

> The adjoining location to the west is described as consisting of red feldspathic gneiss, traversed by large dikes of black trap, and intersected by two sets of veins. One of these appears to occupy the joints of the rock, slipping at a high angle to the northward. These veins are from one to three or four inches in breadth; and they carry in a gangue of quartz,

[36] Ont. Bur. Mines, Vol. XX, 1911, Pt. I, p. 188.
[37] Ont. Bur. Mines, Vol. XXIII, 1914, Pt. II, p. 20.
[38] Mines Branch, Bull. 93, p. 48.
[39] Geol. Surv. Can., Rep. Prog., 1853-4-5-6, p. 40.
[40] Geol. Surv. Can., Rep. Prog., 1851-52, pp. 37 & 41.
[41] Geol. Can., 1863, p. 705.

considerable quantities of yellow and vitreous copper ores, with molybdenite. One vein is, however, described as having a breadth of eight inches, and as having been traced N. 15° E. for a mile and a half, bearing a considerable amount of yellow copper ore, with molybdenite. The other veins are described as running from the shore to a considerable distance inland, and as in many cases remarkable for a breadth of from ten to thirty feet; others attain but a few inches. The gangue of this series of veins is quartz, containing copper pyrites, with occasionally a little galena and blende.

The size of these molybdenite veins is not great enough to warrant exploitation, unless they are of exceptional richness. This, however, does not appear to be the case in view of Logan's statement that of the molybdenite localities mentioned,

The only one of them, so far as known, which affords any available quantity of the mineral is that described as occurring in Quetachoo-Manicougan Bay.[42]

Wabigoon Lake

The following description of the occurrence of molybdenite near Contact bay is given by E. Thomson:

The molybdenite on claim K 645, Contact bay, Wabigoon lake, occurs at a point a few yards from the southwest corner of the claim at the contact between the Laurentian granite and the fine grained Keewatin diorite, in a quartz vein about six inches in width and about 10 feet in length. The vein carries, as well as plates of molybdenite, some pyrite and chalcopyrite. Another occurrence of molybdenite on this same claim is to be found immediately east, at the first point jutting out into the lake east of the Rognon camp. The molybdenite here is right at the water's edge in very small quartz stringers in the regular Keewatin diorite rock, and also to a lesser extent in the country rock itself. It occurs in very tiny flakes, and is associated with pyrite, chalcopyrite, and malachite.

Worthington Mine

Dr. Coleman reports:

Among the minerals at Worthington occasionally a seam of lead gray molybdenite is found crossing the pyrrhotite, or partly enclosed in the greenstone, but the amount is very small. It seems to have been a later deposit in fissures cutting the ore and country rock.[43]

[42] Geol. Can., 1863, p. 755.
[43] Ont. Bur. Mines, Vol. XIV, 1905, Pt. III, p. 161.